Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER'S THESIS

Analysis of the effect of lowest price criterion in the selection process of public procurement

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Declaration of Authorship

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Prague, July 25, 2015

Signature

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Abstract

Public procurement in the Czech Republic is a complex process directly settled by the legal procurement framework which defines various contract-awarding procedures. This study focuses on the part of selection process when procurers can decide between using lowest price criterion or most economically advantageous tender (MEAT). We found an evidence of preference of lowest price criterion, especially in the recent years. The main goal of the study is therefore to provide a comprehensive analysis of the leading drivers of selection of specific criteria and their consequential effects. Taking into account various characteristics of public procurement processes, we found out that in general lowest price criterion is preferred by public contracting authorities and by procurers with larger number of employees. This type of selection process also consequently provides an interesting trade-off between higher competition in terms of number of bidders, higher stability in terms of less interventions by the Office for the Protection of Competition (OPC) but also higher probability of consequent extraworks.

JEL Classification H57, D73, C51, L33

Keywords public procurement, selection process, lowest price criterion, most economically advantageous tender

Abstrakt

Verejné obstarávanie je zložitý proces, priamo upravený právnym rámcom verejných zakázok Českej republiky, ktorý presne definuje rôzne postupy zadávania. Táto práca sa zameriava procesom výberu, v rámci ktorého sa obstarávatelia môžu rozhodnúť medzi použitím kritéria najnižšej ceny alebo ekonomicky najvýhodnejšej ponuky. Najmä v posledných rokoch prevláda trend používania kritéria najnižšej ceny, ktorý sa objavil aj pri skúmaní našich dát. Hlavným cieľom tejto práce je poskytnutie komplexnej analýzy hlavných premenných, ktoré ovplivňujú výber konkrétnych kritérií a ich následné dôsledky. Výsledky naznačujú, že kritérium najnižšej ceny je uprednostňované hlavne u verejných obstarávateľov a u obstarávateľov s väčším počtom zamestnancov. Tento typ kritéria tiež vedie k zaujímavému kompromisu medzi vyššou súťažou v rámci vyššieho počtu uchádzačov, vyššou stabilitou rámci zriedkavejších intervencií zo strany Úradu pre ochranu hospodárskej súťaže (ÚOHS), avšak vyššiou pravdepodobnosťou následných víceprácí.

JEL Klasifikácia H57, D73, C51, L33

Kľúčové slová verejná zakázka, hodnotiace kritériá

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List of Acronyms

CPV	Common procurement vocabulary
CZK	Czech crown
EC	European Commission
EU	European Union
GDP	Grand domestic product
ISO	International Organization for Standardization
LP	Lowest price
LPM	Linear probability model
MEAT	Most economically advantageous tender
OECD	Organisation for Economic Co-operation and Development
OPC	Office for the Protection of Competition
OHSAS	Occupational Health and Safety Management Systems

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Master's Thesis Proposal

Institute of Economic Studies
Faculty of Social Sciences
Charles University in Prague

Author:	Bc. Alexandra Blahová
Supervisor:	PhDr. Ing. Jiří Skuhrovec
Defense Planned:	September 2015

Proposed Topic:

Analysis of the effect of lowest-price criterion in the selection process of public procurement

Motivation:

In the Czech republic, annual public procurement spending corresponds to more than 15 % of GDP. The legal procurement framework in the Czech Republic defines various contract-awarding procedures which differ on the degree of openness to potential suppliers.

In my work, I would like to focus on the evaluation method of the bids and to study the criteria based on which the final winner is awarded. In most of the cases, usually due to the simplicity, public authorities use the lowest-price criterion. But the lowest price selection does not automatically lead to the overall lowest project cost and to the best quality provided. The lowest-price criterion as the only criterion can lead to the actual increase of the project cost due to the consequent public procurement tendering or assigning extra contracts after the original contract is awarded. Several researchers have proposed the adoption of selection procedures that rather take into account multi-criteria selection, often based on both price and non-price criteria. The most common reason for a restricted actual use of multiple-criteria selection is interpreted by the procurer´s limitation in evaluation. Moreover some studies identified more precisely factors which influence tendering practises including public procurement regulation and various personal relations.

My objective is therefore to investigate the effect of the lowest-price criterion as the only criterion in selection process on the overall project cost upon project termination and on the probability of the consecutive public procurements and extra work set to the suppliers. The aim is to compare common practise in the Czech Republic with other central European countries.

Hypotheses:

1. Number of bidders is positively correlated with the lowest price criterion.
2. Lowest-price criterion leads to different market composition, different firms compete in public procurements with lowest-price criterion comparing to those with multi-criterion selection.
3. Public procurements with the lowest-price criterion are more stable than those with the multi-criteria selection; public authorities interfere less in a case of the lowest-price selection process.
4. Lowest-price criterion as the only criterion leads to the consequent public procurement tendering or extra contracts after the original contract is awarded.

Methodology:

In the first part I will focus on the main legal features of public procurement framework in the Czech Republic.

In the second part, I will provide an evidence - based analysis using standard econometric approaches. Many studies have identified various drivers of the final price, e.g. Pavel (2010) proved a negative effect of the number of bidders on the final price of the public procurement in the infrastructure sector using regression analysis. I will focus on different selection criteria with an emphasis on the lowest-price criterion as the only criterion in the selection process and I will test the above stated hypothesis through regression analysis based on the standard ordinary least square method. The models will attempt to identify relationships between the used selection criteria as the independent variable and the institutional settings of procurement such as number of bidders, market composition, stability and consequent tendering as the dependent variable. In order to avoid a possible endogenity bias resulting from omitted variable problem, I will add several variables such as anticipated value of the contract and specific characteristics of the contracting authority, as well as binominal variables such as type of supplier and presence of subcontractors.

I am planning on examining a comprehensive database of the available observations corresponding to the set of public procurement contracts awarded within the last years. I will use the data available in the Journal of Procurement.

Outline:

1. Introduction
2. Legal framework
   a. Public procurement methods
   b. Classification of public procurement methods based on statutory thresholds
   c. Evaluation and selection procedures
3. Anticipated value of public procurement
4. Literature review
5. Data description
6. Empirical analysis
7. Conclusion

Core Bibliography:

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Author **Supervisor**

1 Introduction

Public procurement is a general concept of purchasing from public sources with several specific institutional characteristics. Lately, the issue of public procurement has become an actively monitored and publicaly discussed topic. The reason is especially its significant economic importance in gross domestic product across all OECD countries. The average is around 10 – 15 % of GDP. In most developed countries, the proportion accounts to 25 %. In the Czech Republic total expenditures on procurement of goods, services and construction works cover around 14,75 % of GDP (European Commission, 2014).

Countries in the European Union are subject to a procurement directive which regulates procurement of either public, subsidized or sector authorities above certain threshold values. In the Czech Republic, these rules were incorporated in the Public Procurement Act which regulates the process of procurement and which is periodically updated. Within this legal framework the selection criteria can be defined either as lowest price criterion or most economically advantageous tender (MEAT), depending on the preferences of contracting authority. In the recent years, contracting authorities prefere to award tenders more often based on the lowest price criterion than MEAT. But the lowest price selection does not automatically lead to the overall lowest project cost and to the best quality provided; actually the opposite effect might be present more often in reality.

Therefore, we decided to focus on analysis of the effect of lowest-price criterion in the selection process of public procurement. In response to this, we compare how various selection procedures are used; we identify variables which determine the specific selection procedure and the consequential effects of specific selection criteria.

The topic of public procurement is relatively new, it started to be analysed in the beginning of 80s. One of the very first studies is a study of Kuhlman, Johnson (1983) who identified an effect of number of bidders on the final price of contracts awarded. Further studies related to the topic of public procurement focused rather on the procurement system as a whole and they tried to determine optimal strategies in the procedure, such as studies of Bulow and Robert (1989), Domberg (1995) or Naegelen and Mougeot (1998). In the Czech Republic, the topic of public procurement is actively studied as well. Researches focus mainly on practices in contract awarding

procedures. Nikolovová, Palguta, Pertold, Vozár (2012) studied manipulated behavior of procurers around thresholds for various types of procedures and they concluded that procedures which are more open and transparent lead to lower final price and higher number of bidders. Very similar results presented also Palguta (2013) who revieled a strategy of contracting authorities to manipulate the anticipated values of procurement contracts. Literature studying the effects of specific selection criterions is very limited. Pavel (2008) found out a positive effect of lowest price criterion on number of bidders in public procurement oriented on construction sector. Some more studies focused on overall project cost and quality provided depending on selected selection criteria (Wong et al., 2001, Christodoulou et al., 2004, Ling, 2004). But to author's knowledge, a compact study of the drivers and effects of using various selection criteria has not been presented yet and it is missing for a proper description of a public procurement system.

Thesis is organized as follows. Following chapter provides a detailed description of key principles and basic concepts of public procurement in the Czech Republic supported by theoretical background settled by the Public Procurement Act no. 137/2006. Third section describes the whole process of public procurement from the moment of procurement initiation, through evaluation and selection procedures to signature of final contract. Next section focuses on the importance of public procurement in the Czech Republic and it presents development of total value of public procurement between the years 2009 and 2014. The literature overview chapter introduces and reviews recent studies and publications on public procurement with a focus on three aspects: behavior of bidders, behavior of procurers and the effect of their mutual cooperation.

The consequent chapter presents an empirical analysis of contracts awarded in public procurements between 2006 and 2014. The analysis provides facts and consequential effects studied through econometric models. In general, models are designed to control for type of procedure, specification of sector, specification of selection criteria, characteristics of procurer and supplier and time dimension. Further variations of the models with more characteristics are applied where it is suitable. Finally, in summary, we present our main findings and propose some recommendations.

2 Key principles and basic concepts of public procurement

Realization of major projects by state is implemented by using an institute of public contracts. State hires private companies for acquisition of goods, providing services or execution of construction works, while these contracts are allocated through public procurement.

The consequent part of the thesis provides a definition of public procurement and briefly describes legal framework in the Czech Republic. In particular, its goal is to present basic terms and methods used in public procurement which will be later studied on real data. It also determines various types of contracting authorities and presents how different procurement procedures affect evaluation and selection process.

2.1 Legal framework

Public procurement is defined officially in Czech legislation through a concept of public contract as a contract between two entities, contracting authority and one or more economic operators, whose subject is supply of products, provision of services or execution of public works. The public contract which is awarded under the Act is carried out on writing basis (§ 7 of Act no. 137/2006).

From a policy perspective there is a relationship between two agents which may provoke an abusive behaviour. An actual functioning of the principle of public procurement has been very often threatened by negative behaviour such as corruption or collusive cartel. The first case, corruption, represents an illegal connection of some representatives of the contracting authority and one or more companies whose aim is to influence the results of the tender. The second case, collusive cartel, is defined as an illegal coordination of the procedures, especially the settlement of price bids between bidders (Pavel, 2008). Both of these negative behaviour procedures have a negative impact on the final price, causing it to increase, and therefore they affect an efficiency of public spending. The public sector then purchases required public order at final price higher than the justified cost of the project. Consecutively, non-transparent public procurement and corruption lead to lower competitiveness of the whole market. As a solution to avoid these practices, there is proposed a tendency of

maximizing number of competitors which should lead to more open and transparent tendering with lower probability of corruption or collusive cartel. As an external effect of higher number of competitors, we can expect lower final price. This is an essential reason why it is important to have well set rules for the whole contracting process.

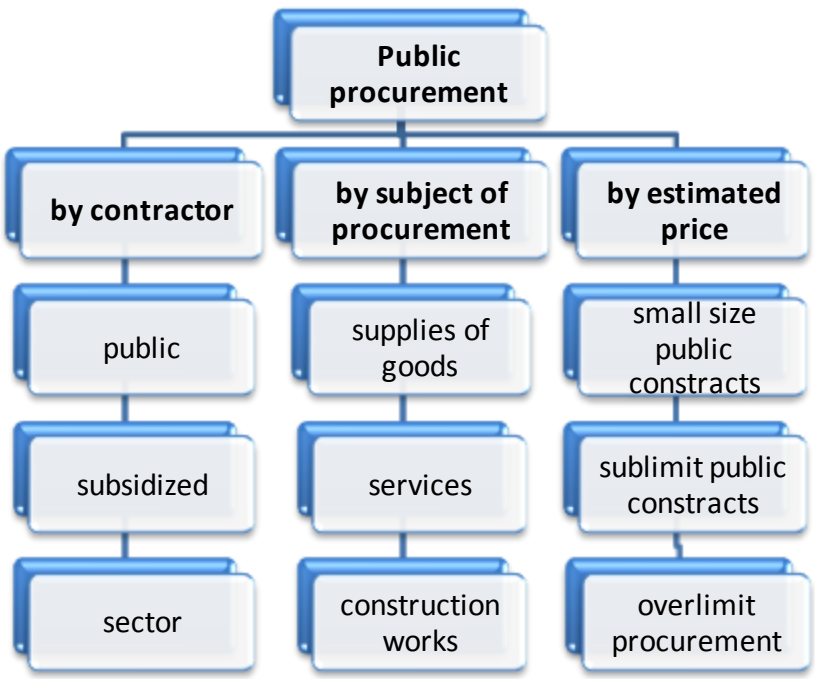
All national legal regulations within the European Union must generally respect fundamental principles stemming from the European Community Treaty, especially the principle of transparency, non-discrimination, equal treatment and mutual recognition. Application of public procurement orders and concessions in the Czech Republic is imposed by the Public Procurement Act no. 137/2006 (hereinafter the "Act") and the Act no. 139/2006 on Concession Contracts and Concession Procedure (hereinafter the "Concessions Act"). The surveillance is carried out by the Office for the protection of competition (OPC) which represents a supreme state supervisory authority. Its main task is to monitor contracting authorities in processing public contracts, including publication of awarded public contracts. Notice publication and public administration of contracts awarded through public procurement system is carried out by the public procurement information system administrated by the Ministry for Regional Development, Public Procurement Gazette. The Ministry for Regional Development is also responsible for drafting method guidelines for the process of public contracting and it is involved in relevant legislation.

Legal regulation for public procurement in the Czech Republic has passed several changes. Their goal has always been to minimise the weaknesses identified in the application of current legislation and to provide simplification, clarity and transparency to the whole process of public procurement. The most significant impact was documented after legislative changes (also called "Great transparent amendment of the Act") which have been effective since 1st of April 2012. It was generally expected that stricter rules would slow down public spending. Nevertheless, this effect was not acclaimed. Instead of expected decline in the volume of public procurement, in most of the sectors and groups of contracting authorities, an increase in total orders has been observed (Skuhrovec, 2014). The newest amendment has been effective since the end of February 2015 and its aim is to make the placement of public orders simpler. The main change is that the duty to abolish a tender if only one bid is received has been canceled and the proceedings to OPC have been accelerated as the communication will be available in electronic form. The limit for the placing extraworks with the same supplier has been raised from the present 20 to 30 percent of the original price.

2.2 Classification of public procurement

In general, the classification of public procurement is defined by the Act and it is presented in the following chart. The Act determines public procurement and defines various types according to the type of contractor, subject of procurement and estimated price. It induces also various types of public procurement which differ in terms of openness, formalities and transparency, such as open procedure, restricted procedure, negotiation with publication, negotiation without publication, competitive dialogue and simplified below threshold procedure. Each of them has specific rules and pre conditions requested to be fulfilled during the whole process of public procurement.

Figure 1: Classification of public procurement



Source: The Act

A procurer (also called contracting authority) can be a natural person, a legal entity or a number of procurers who are associated for a purpose of public contract (necessary pre condition is a written contract). For the purposes of determination of various public procurement methods, the Act first defines three types of procurers assessing public contracts through public procurement (§ 2 of Act no. 137/2006):

1. **public authority** is represented by the Czech Republic, state-funded organization, local government unit and their organization or other non-commercial organizations set or financed by the Czech Republic,

2. **subsidized authority** is either natural or legal person whose contract is financed by more than 50 % from public resources,

3. **sector authority** either performs activities with special or exclusive rights or a public authority has a direct or indirect influence on it.

There is also an institute of **central authority** defined such as a person performing centralized procurement on behalf of the original procurer (§ 3 of Act no. 137/2006). Depending on the subject of public procurement, public tenders are further divided into three categories:

1. **public contracts for supplies of goods** whose subject of tendering is an acquisition of goods either by purchase, hiring or leasing goods with subsequent right to purchase those goods,

2. **public contracts for construction works** whose subject is a building work or construction of buildings with related project and engineering activities,

3. **public contracts for services** which cover any contract which does not fit into the section of public contracts for supplies of goods or construction works.

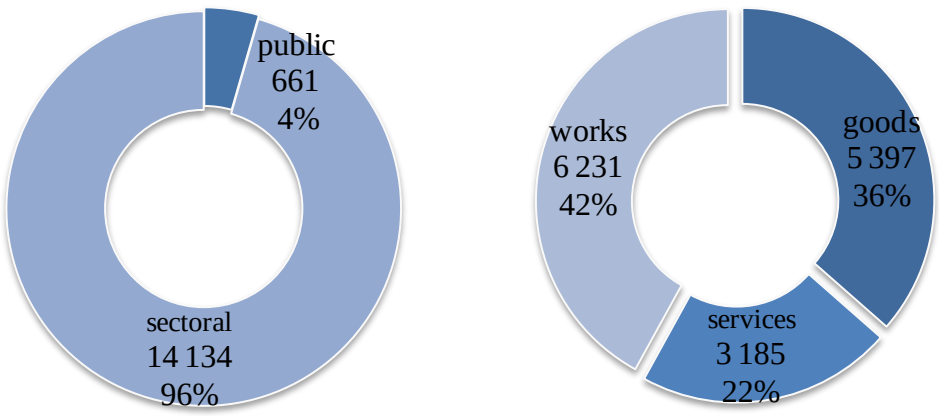
In case of repeated providing of similar supplies of goods, services or construction work, contracting authorities may conclude a **framework contract** with one or more suppliers. A framework contract concluded with one supplier is determined on the basis of orders and in case of more suppliers; they are invited to submit offers for partial performance (§ 11 of Act no. 137/2006).

In 2014, 14 795 contracts were allocated through public procurement and published in Public Procurement Gazette[1] in total value exceeding 370 bill. CZK without VAT. The following figure represents a percentage share of number of contracts of different types of public procurement based on type of procurer and subject of tendering. As we can see sectoral procurers exceed significantly public procurers in public procurement. Comparing different types of public procurement based on the subject of contract, the most numerous, in number of total contract awarded, is a group of execution of construction works, there were 6 213 contracts, followed by supplying goods with 5 397 contracts. The least contracts were awarded in order to provide services, only 3 185. Nevertheless comparing the share in total value of these

[1] Available at www.isvz.cz,

contracts, around one third of total value of all contracts was allocated in order to supply goods, covering around 160 bill. CZK and another third was allocated in order to execute construction works, covering around 130 bill. CZK. The smallest share in public procurement was covered by providing services, slightly exceeding 80 bill. CZK.

Figure 2: Public procurement based on type of procurer and subject of procurement in 2014



Source: Public Procurement Gazette, 2014

2.3 Classification of public procurement based on statutory thresholds

Statutory thresholds determine various types of public procurement and their specific rules. There is a distinction between the thresholds for contracting supplies, services and works. In general, the limits change every two years based on the amendments in European legislation. The categories are:

1. **small size public contracts** – contracts whose expected price is lower than 2 mil. CZK in case of supplies of goods and services or 6 mil. CZK in case of construction works. These limits were increased by the Amendment in January 2014 and this increase was believed to lead to reduction of administrative burden and to more flexibility for contracting authorities using this type of procurement. Processing small size public contracts, a procurer does not have to follow the process determined by the Act but they have to fulfil the requirement of transparency, equal treatment and non-discrimination.

2. **sublimit public contracts** – contracts whose expected price is higher than 2 mil. CZK in case of supplies of goods and services or 6 mil. CZK in case of construction works and upper limit is set based on the limits for over limit public contracts.

3. **over limit public contracts** – contracts whose expected price reaches the lower financial limit determined by Government Regulation. These limits vary based on the subject of procurement and in case of supplies of goods and services; they also vary based on the category of procurer.

2.4 Methods of public procurement

The Act distinguishes the following types of public procurement. Each type determines different process of tendering procedure in terms of invited tenderers, openness of the whole procurement process and other specific charackteristics.

Open procedure

This type of public procurement is open to unlimited number of bidders and it is characterised by no restrictions and no legal preconditions which need to be fulfilled. Therefore it is considered to be the most transparent.

Restricted procedure

A contracting authority can invite an unrestricted number of tenderers (in case of specific criteria in public procurement for the areas of defence and security, the number of bidders can be restricted). But comparing to the open procedure, the selection process has two rounds. In the first one, interested bidders submit their proof of qualification and the consequent tenders can be submitted only by those who have demonstrated their qualification and have been invited by the procurer to the restricted procedure.

Negotiation procedure with publication

This type of procedure is open to unrestricted number of bidders (in case of specific criteria in public procurement for the areas of defence and security, the number of bidders can be restricted). They submit their application with a proof of qualification based on the published notification. The conditions of submitted bids are consequently negotiated with contracting authority with an aim to achieve the most advantageous conditions of public contracts.

Negotiation procedure without publication

In this type of procedure, the contracting authority invites directly a restricted number of potential tenderers to negotiation which offers a very simple and informal process. The cases in which a contracting authority can use this type of procurement are strictly determined by the Act (§ 23 of Act no. 137/2006); only one tenderer is invited in case of exclusive rights, artistic reasons, supplementary works, order of supplies in liquidation, more but limited number of tenderers can be invited in case of extremely urgent situation, orders for research and development or unsuccessful previous tendering procedure. This type of procurement is also legal in case of proven financial advantage steaming from this type of tendering.

Competitive dialogue

This type of procurement is also undertaken in two rounds. In the first one, using a competitive dialogue announcement, a contracting authority invites an unlimited number of bidders to submit their application with proof of qualification. In the second part, the selected bidders are invited to take part in the competitive dialogue whose goal is to find preferably one or more suitable solutions in order to fulfil the public contract.

Simplified below-threshold procedure

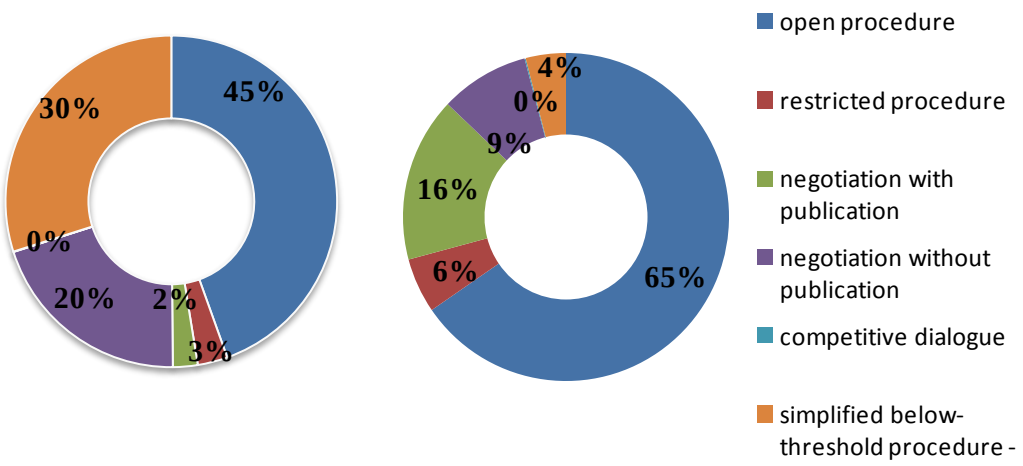
Comparing to the previous types of procurements, in simplified below-threshold procedure a contracting authority invites at least five bidders to the procurement and publishes an invitation on its public profile. Number of applying tenderers is unrestricted and every tenderer who submits a solemn declaration of fulfilment of the required qualifications is considered as a qualified tenderer.

The types of public procurement are determined by the European Directives (EU Directive 2004/18/EC, The Public Contracts Directive), the only exeption is simplified below-threshold procedure which is speciality only for Czech procurement environment.

The following figure represents a percentage share of different types of public procurement based on procurement method used for tendering in 2014. The first chart represents a division according to total numbers of contracts awarded through certain type of procurement and the second chart represents share in total value of these contracts. An interesting fact is that the share in number of contracts allocated through various types of public procurement does not correspond to the share in their total value. As we can see open procedure, as the most transparent type of public procurement, is dominant in both cases and it exceeds significantly all other types,

covering almost one half of all contracts' allocation with a total value of almost 65 % of all awarded contracts. Almost one third of all contracts is allocated through simplified below-threshold procedure whereas in total value, they account only around 4 %. Negotiation with publication exceeds negotiation without publication in total value of contracts, 16 % vs. 3 % but in number of contracts procurers prefer negotiation without publication with covering around 20 % of all procurements comparing to 9 % of negotiation with publication. The least preferred type is competitive dialogue. In 2014, it was used just 5 times in order to award a public contract.

Figure 3: Public procurement based on tendering method in number of contracts and in total value of contracts in 2014



Source: Public Procurement Gazette

2.5 Qualification requirements for tenderers

Tender evaluations are often based on a combination of general requirements covering criteria that the tenderer must fulfil such as qualification, financial and managerial criteria and project-specific criteria. Based on them the submitted bids are evaluated. We normally refer to them as **evaluation criteria**. The Act distinguishes qualification criteria for public and sector procurer. Sectoral contracting authority can set any objective requirements (§ 63 of Act no. 137/2006) so it is his responsibility to test the qualifications of tenderers. Whereas the Act defines following basic groups of general requirements that are usually a pre-condition for tenderer in procurements organised by public contracting authorities (§ 50 of Act no. 137/2006):

1. **basic qualification requirements** based on which tenderers demonstrate a basic general competence in public contracts,

2. **professional qualification requirements** based on which tenderers demonstrate professional capacity. Submitting a Certificate of incorporation and extract from the Trade Register is legally required. Contracting authorities can request various additional professional requirements necessary for execution of the contract (requirements for education, certificates, qualification, experience, …)

3. **economic qualification requirements** based on which tenderers demonstrate economic competence in public contract. Since the 1st April 2012, based on the amendment of the Act, the actual evidence was replaced by submission of an affidavit about the fulfilment.

4. **technical qualification requirements** based on which tenderers demonstrate technical capacity which is determined by contracting authorities in tender documentation. Since the amendment of the Act in the 1st April 2012, specific quality management systems such as ISO, OHSAS, etc. are prohibited to be requested (Vyklický, 2013).

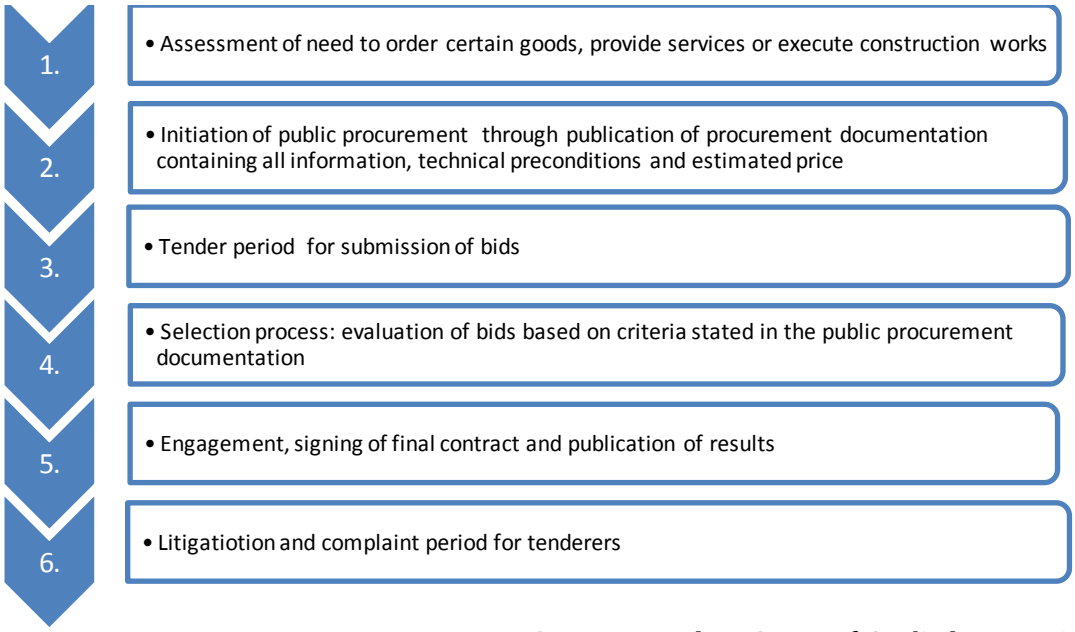
A tenderer can decide to prove certain of required requirements by **sub-contractor.** Sub-contractor is defined by the Act as a person through which the economic operator performs a certain proportion of a public contract or which is to provide certain things or rights to the economic operator to perform the public contract (§ 17i of Act no. 137/2006).

3 Process of public procurement

Public procurement, in general, is a specific process of contracting when one of the contractors is a procurer defined by the Act and the second contractor is a supplier. An administrative procedure of the whole procurement process is then defined from the moment of preliminary notices, through evaluation procedure, selection and signing final contract. The main goal is saving financial, mainly public, resources and providing transparent and effective market competition.

This part of the thesis describes a general process of public procurement and focuses on the determination of estimated price and selection criteria. It also discusses an effectiveness of selection based on the lowest-price criterion versus MEAT selection procedures taking into account both qualitative and quantitative aspects of the tender. From the perspective of contracting authority, the whole process of contracting has certain steps. The first step is to identify needs as well as determine procurement procedure and technique. The procurement process is officially initiated either by invitation to submit tenders or by publication of the notice about initiation of public procurement, depending on the type of procurement. These two basic forms of initiation are determined by the Act (§ 26 of Act no. 137/2006) and no other form of initiation is enabled. Publishing a preliminary notice in the Public Procurement Gazette includes a text of the procurement documentation with a determination of type of procurement (open, restricted or simplified bellowed-threshold...). The procurer sets a period for submission of tenders and he is responsible for managing receipt of proposals, checking general information requirements and evaluating received bids. As soon as the procurement process is completed, the contracting authority publishes on the Public Procurement Gazette a written report and public authority publishes also a signed contract. Finally, bidders have a period during which they can express their complaints and contracting authorities have to manage them.

Figure 4: General concept of public procurement



Source: Based on Center of Applied Economics

Each tenderer is allowed to submit only one tender. Nevertheless, group of tenderers may submit a joint tender. In this case, the tender is considered as a single tender in selection process. Consequently a contracting authority sets a tender period regarding type of procurement method and subject of contracting. This period lasts from the end of period for submission until the delivery of the notice on the selection of the best tender. During the tender period, all candidates are bound by their tenders, they cannot cancel it or change it and in case that their tender is accepted, they have to sign a contract.

3.1 Estimated value of public contracts

Estimated value of a public contract is defined by the Act as an amount of financial liability estimated by the contracting entity. The contracting authority is supposed to calculate the estimated price on the basis of data and information on equal or similar contracts and in case that such information is not available, the contracting authority conducts a market research of required performance or he gains the necessary information by another suitable mean. The estimated price is defined by the Act (§ 13 of Act no. 137/2006) as a price net of value added tax.

Table 1: Methods for estimation of the value of public procurement

Subject of public procurement	Method of estimation value of public procurement	Process
Supply contract	Market research	Interviews/ surveys/ questionnaires
Service contract	Catalogue prices	Analysis of catalogue prices
Construction works contract	Calculation of costs	Estimation of potential costs related to execution of the project.

Source: Based on Ochrana (2011)

The goal is to set the price according to which the procurer defines type of public procurement. It is forbidden by the Act to subdivide the procurement of the same subject with an intention to get below financial threshold with lower estimated price.

3.2 Selection criteria

Contracting authority has to define properly in procurement documentation parameters based on which he will evaluate the tenders. According to the Act (§ 78 of Act no. 137/2006) he can use two types of evaluation criteria: **economic advantageousness of the tender (MEAT)** or **the lowest price**.

When price per unit is the only real factor that distinguishes one bid from another, after meeting all revlevant minimum quality requirements, using lowest price awarding criterion is preferred by contracting authorities. But in a case of more specific subject of procurement when bides can differ significantly, procurer have an opportunity to apply MEAT selection. In MEAT selection, price is always considered as well but it is accomplished with other specific criteria selected by contracting authority which take into account two important aspects: quality and overall costs including guarantees and maintenance. There are various reasons to determine extra criteria in MEAT selection, saving effect over the life-time of the project, security, ecological reasons, etc. High quality supplier can have a significant saving effect on maintenance and operations over the life-time of the whole project. Consequently, selection of the lowest bid may lead to the necessity of more time and funds over the life-cycle of the project than MEAT-based procurement.

The procurement selection process which put price too much in focus, therefore apply only lowest-price criterion, have been lately subjected to criticism. To understand

both opportunities and risks steaming from both possible selection processes, more practical picture exploring these issues is presented later on.

In case of determination of partial evaluation criteria in MEAT selection, contracting authorities always have to look for relationship between selected value and price of the criterion. High weight cannot be assigned to the quality criterion whose weight is negligible compared to its price. Based on the study on procurement regulation in European countries prepared for the European Commission by Pwc in March 2011, it was found that selection criteria depends on the type and subject of the procurement. The lowest price criterion is mostly used in the least complicated procedures, such as negotiation without publication whereas in negotiation with publication or restricted procurements procurers prefer awarding contracts based on MEAT selection. There is also higher propensity to use the lowest price in order to contract supply of goods or execution of construction works than providing services. Overall, 65 % of total value of contracts awarded based on the lowest price criterion is tendered in open procedure purchases. Analysing costs of different types of procurement process, they concluded that MEAT selection uses significantly more resources than the lowest price criterion as it requires more effort from both contracting authorities and tenderers (Pwc, 2011).

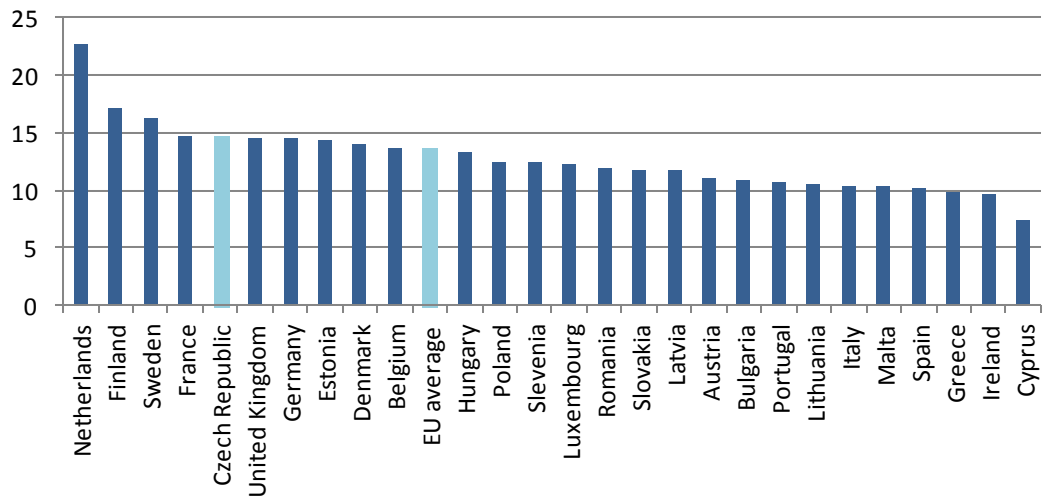
New European legislation was transformed also to Czech legislation and since February 2015 there are some improvements considering selection criteria. In a cae when the quality of employees affects strongly the realization of the contract, contracting authority can evaluate organization, qualification and experience of the team realizing the contract as a part of the MEAT selection.

It is also possible to settle a fixed price and the bidders will compete just in offered quality of exeution. Than all the expenditures connected to the useful life of the subject of procurement are computed based on the formula determined by the procurer.

4 Importance of public procurement in the Czech Republic

The economic importance of public procurement in gross domestic product is significant. In OECD countries the average is around 10 - 15 % of GDP and in the most developed countries, the proportion is much higher, it covers up to 25 %. Comparing to other European countries, in 2012 in the Czech Republic total expenditures on public procurement for goods, services and works (excluding utilities) accounted for 14,73 % of GDP, which was the fifth highest share of GDP in the EU. A complete overview of all EU countries is shown in the following Figure. The highest share of public resources allocated through the process of public procurement is in Netherlands (22,76 %) and the lowest share is in Cyprus (9,6 %). An European average is 13,74 % which corresponds to the world average in OECD countries (European Commission, 2014).

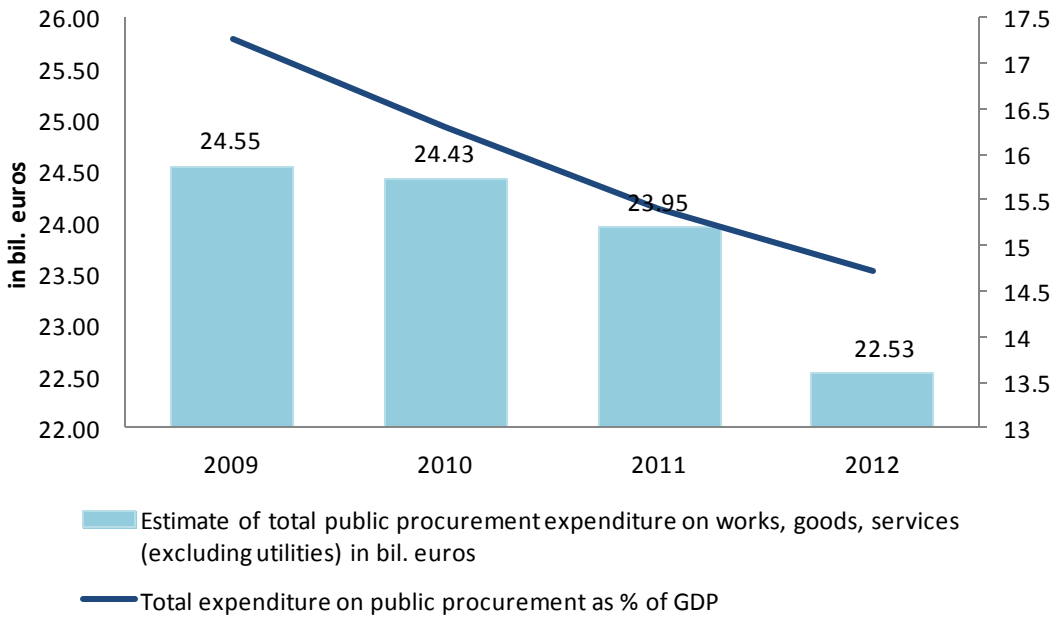
Figure 5: Total expenditures on public procurement for goods, services and works (excluding utilities) in bill. Euros as % of GDP in 2012



Source: Public procurement indicators 2012, European Commission (2014)

The development of total value of public procurement on goods, services and contruction works (excluding utilities) and share of public procurement on GDP in the Czech Republic is shown in the following Figure. Even though they have both slightly decreasing character between years 2009 and 2012, public procurement still creates a significant share of GDP.

Figure 6: Development of total value of public procurement and share of public procurement on GDP in the Czech Republic between 2009 and 2012



Source: Public procurement indicators 2012, European Commossion (2014)

5 Literature review

Literature related to the topic of public procurement analyses in general three aspects of the procedure: behaviour of bidders, behaviour of procurers and the effect of their mutual cooperation. Most of these works have tried to determine the optimal strategies in the procedure, such as Bulow and Robert (1989), Domberg (1995) or Naegelen and Mougeot (1998).

One of the very first studies, focused on the topic of public procurement, was published by Kuhlman, Johnson (1983). Using econometric approach they identified effect of number of bidders on the final price of contracts awarded to highway construction in the United States and they determined marginal effect of additional bidder on decrease of the final price by approximately 2 % of the estimated price.

For the purposes of this work, research on public procurement practices in the Central Europe, especially in the Czech Republic is very important. In effort to make public procurement more transparent and reduce possible corruption, legal framework determines financial thresholds for various types of public procurement. Few studies have documented illicit or manipulated behaviour steaming from nonlinear incentives in these thresholds. Nikolovová, Palguta, Pertold, Vozár (2012) analysed behaviour of procurers in public procurement procedures in the Czech Republic. Using quantitative methods they detected a presence of significant accumulation of procurements under the thresholds and they also concluded that openness of the procurement procedure leads to lower final price and higher number of bidders. In connection to the previous study, Palguta (2013) analysed nonlinear structure of procurement regulation in the Czech Republic. He discovered that "procuring officials apparently manipulate the anticipated values of procurement contracts in order for these contracts to be awarded through more restricted and less transparent procurement procedures". In 2013, Vyklický determined the barriers for SMEs to enter the public procurement market in the Czech Republic, such as qualification requirements, direct and indirect discrimination of tenderers by contracting authorities, cost of processing tenders for public contracts and inappropriately provided partial evaluation criteria.

In 2008 Pavel examined Czech public procurement practices in a construction sector and he studied the effect of number of competitors, type of public procurement and weight of the criterion of the lowest price on the final price. He found out a negative correlation between number of competitors and final price, according to his results

"every additional competitor leads to decrease in final price in average by 4,4 % of the estimated price". He also found out a negative effect of using restricted tendering procedure: "using restricted tendering procedure leads to higher final price comparing to the open tendering procedure by approximately 19,8 % of the estimated price".

Surprising result was found out about the effect of the lowest price selection criterion on the final price. Pavel concludes a positive relation between this variable and number of competitors, concretely "lowering a weight of the criterion of the lowest price from 100 to 50 % leads to decrease of number of competitors by 4 and increase of final price by 18 % of estimated price in average" (Pavel, 2008). Pavel also focused on Slovak public procurement practices and in 2010 he examined 100 tendering contracts of infrastructure engineering exceeding 40 million SKK which were mostly awarded in open contest. His work focused on the determinants of the final price of the contract. He proved expected negative correlation between number of bidders and final price and he found out decreasing marginal effect of the additional bidders "every additional competitor leads to decrease in final price in average by 5 - 8 % of the estimated price". The marginal effects of additional competitors are very similar in the Czech and Slovak Republic.

Literature studying specifically criterions in the selection process of public procurement is very limited. There are some studies studying criteria in concrete sectors in different countries, nevertheless, studies focused on selection criteria in public procurement are still falling behind research focused on purchases of the private sector. Some researches have studied MEAT selection which includes both price and non-price criteria. The anticipated logic behind it is that the selection based on the lowest price criterion does not guarantee the overall lowest price upon project completion (Wong et al., 2001) nor the lowest cost during the life cycle (Christodoulou et al., 2004). Moreover, one sided focus on the lowest price does not necessarily provide the best quality or the highest satisfaction (Ling, 2004).

Based on the literature overview we can conclude the importance of the number of bidders and the level of openness of the public procurement. Those two criterions lead in general to lower final price.

6 Empirical analysis

The following section presents an empirical evidence of the effect of lowest price criterion in the selection process of public procurement. It is directly linked to the previous section, theoretical background. The section is organised in four subsections explaining the process of empirical analysis. The first subsection presents motivation for the research and it is followed then by data description, hypotheses and model definition. At the end, results are presented together with a discussion about their possible implications.

6.1 Motivation

To authors' knowledge, the issue of detail comparisons of efficiency of procurements tendered in the Czech Republic based on the lowest price criterion and MEAT selection has not been studied yet. There are mostly various studies devoted to analysing the effects of different types of procurements and determinants of price and quality.

As a result of previous theoretical description of public procurement and previous empirical studies, we expect to reveal statistically significant positive effect of lowest price criterion on number of bidders (Pavel, 2008). In other words, public procurements with lowest price criterion are more tentative for potential tenderers because they find them more transparent. We also expect that lowest price criterion leads to different market composition, that profit seeking firms which are smaller in terms of number of employees compete more in this kind of procurement and that contracts awarded based on the lowest price criterion are more stable, Office for the protection of competition intervenes less in case of procurements with lowest price selection procedure. Moreover we expect that the selection procedure depends on type of contracting authorities and their number of employees. Bigger firms are expected to have more resources to prepare procurements with MEAT selection process whereas micro and small firms with less employees prefer less sophisticated procurements tendered based on the lowest price selection criteria.

6.2 Data description

The dataset covers data available on public procurements with their specific characteristics, awarded in the Czech Republic within a period from July 2006 to January 2015. Data about the public procurement is published in the Czech national informational system Procurement Gazette (ISVZ[2]) and is publicly available. Nevertheless the database has some shortcomings. The information is provided just for single procurement procedures or assigned contracts and there is no entire database for all awarded procedures provided. Moreover a lot of observations are incomplete as the procurers are not penalized for incomplete fulfilment of the forms. For the purpose of this empirical study, data was automatically selected from the Procurement Gazette and formed into a database.

In total the dataset has 130 490 observations of awarded contracts which cover 92 497 procedures (some procedures are divided into several parts with different winners) and 8 173 contracting authorities. Some of the characteristics of the observations were missing due to improper fulfilment of the forms so they were automatically disregarded. The drop off rate is very low and a sufficiently large amount of observations remained. We consider the dataset to be a random sample of awarded procurements and we can use it for further statistical and econometrical analysis.

The following table provides a division of awarded contracts by method and subject of procurement process.

Table 2: Basic characteristics of studied sample of procurements

Award procedure	**Act no.137/ 2006**	**Number of awarded contracts**				
		Overall	**Percentage share**	**Supply of goods**	**Services**	**Constr. works**
Open	**§ 27**	64 675	51,3 %	24 380	26 668	13 627
Restricted	**§ 28**	4 112	3,3 %	366	706	3 040
Negotiation with publication	**§ 29**	22 030	17,5 %	5 664	6 525	9 841
Negotiation without publication	**§ 34**	20 291	16,1 %	4 198	7 535	8 558

[2] Available at www.isvzus.cz

Competitive dialogue	**§ 35**	52	0,04 %	14	35	3
Simplified below-threshold	**§ 38**	14 898	11,8 %	5 368	5 995	3 535
Total		**126 058**	**100 %**	**39 990**	**47 464**	**38 604**

Source: author's calculation

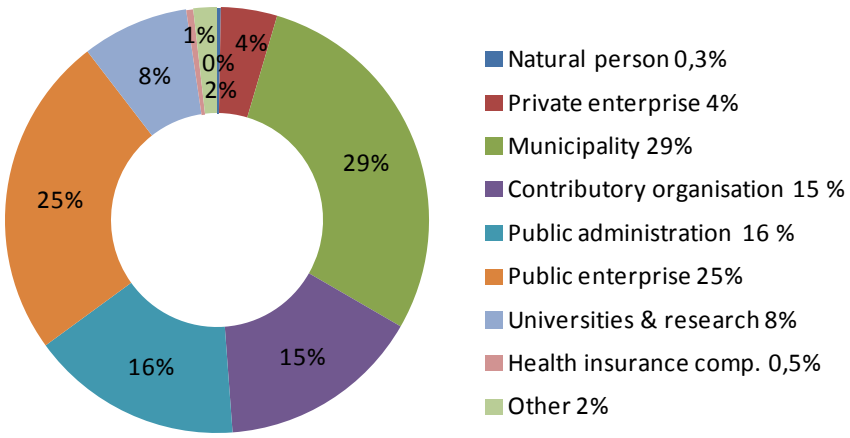
Unit of observation in this empirical analysis is a procurement project. The database provides following information about each project:

- characteristics of procuring bodies (legal form, number of employees),
- characteristics of suppliers (legal forms),
- characteristics of the project (subject of procurement, CPV category, anticipated and final price),
- number of bidders,
- characteristics of the contract-awarding process (method of procurement and type of selection criteria),
- court interference (OPC intervention),
- EU funding,
- external administrator.

6.2.1 Effect of type of procuring authority on the selection process

As it has already been mentioned in the theoretical section, a procurer can be a natural person, a legal entity or a number of associated procurers. The Act defines three types of procurers (public, subsidized and sector). For the purposes of this empirical research we have determined 8 groups of contractors based on the categories of the Czech Statistical Office depending primary on their legal form and secondary on their institutional sector. Almost one third of all contracts awarded have been awarded by municipalities (villages, cities and districts of the Czech Republic), closely followed by public enterprises. Negligible percentage of contracts has been awarded by natural people and health insurance companies, around 1 % of all contracts.

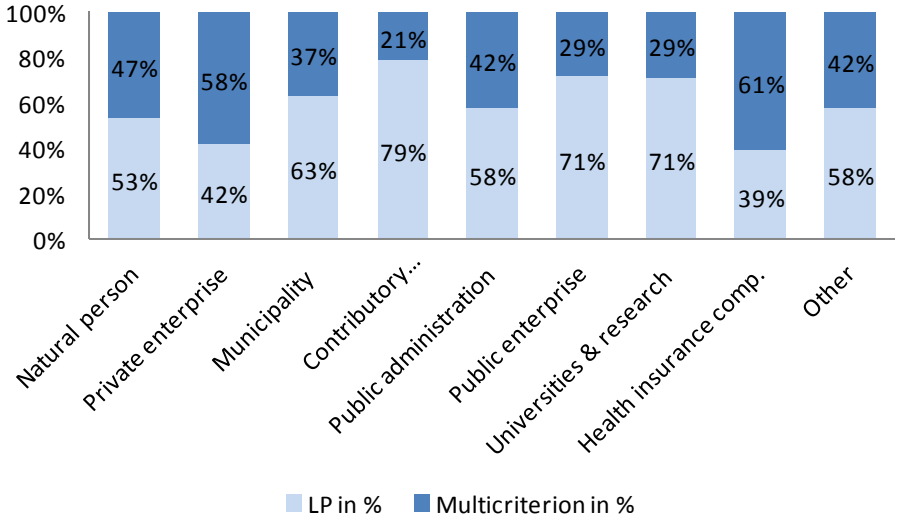
Figure 7: Proportion of contract authorities in all contracts awarded



Source: author's calculation

The following graph represents the percentage of using lowest price criterion in the selection process compared to MEAT selection. Except for private enterprise and health insurance companies, whose percentage of using lowest price criterion is around 40 % of all contracts awarded, all types of contracting authorities prefer the lowest price criterion as the selection criterion. In public enterprises and universities and research institutions selection based on the lowest price has been used in more than 70 % and in contributory organisation it has reached almost 80 % of all contracts awarded.

Figure 8: Lowest price criterion among different contracting authorities



Source: author's calculation

Based on the regulation of the European Union - Commission Regulation (EC) no. 800/2008 we have divided contracting authorities into four groups according to their number of employees. The following table defines these categories.

Table 3: Type of contracting authority according to the number of employees

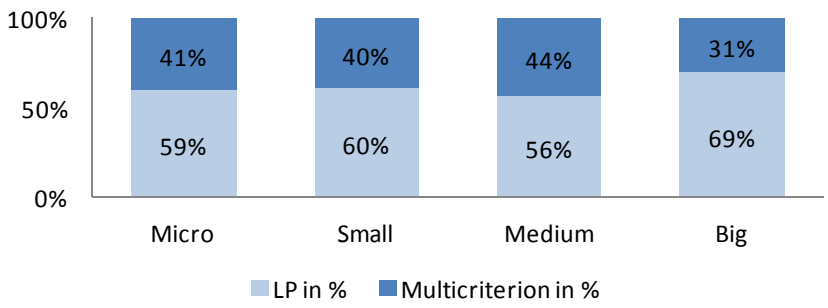
Type of enterprise	Number of employees	Percentage share in the dataset
Micro procurer	Less than 10 employees	5 %
Small procurer	10 – 50 employees	8 %
Medium procurer	50 – 250 emloyees	15 %
Large procurer	More than 250 emloyees	72 %

Source: author's calculation

In terms of number of employees, large procurers are the most common contracting authorities; they administrate 72 % of all contracts awarded. They are followed by medium procurers. In general we can say that the smaller company the smaller share in the dataset of tendered contracts.

The percentage share of lowest price criterion used in awarded contracts is approximately stable within all four categories of contracting authorities. It covers from 56 % to 69 % of all contracts awarded, on average it is around 60 %. But we would expect that larger procurers have more resources and they would prefer more sophisticated selection process, MEAT selection. In reality, large contracting authorities have used lowest price criterion in 69 % of all awarded contracts which is the largest share comparing to the other three categories of contracting authorities with less employees.

Figure 9: Lowest price criterion among different contracting authorities

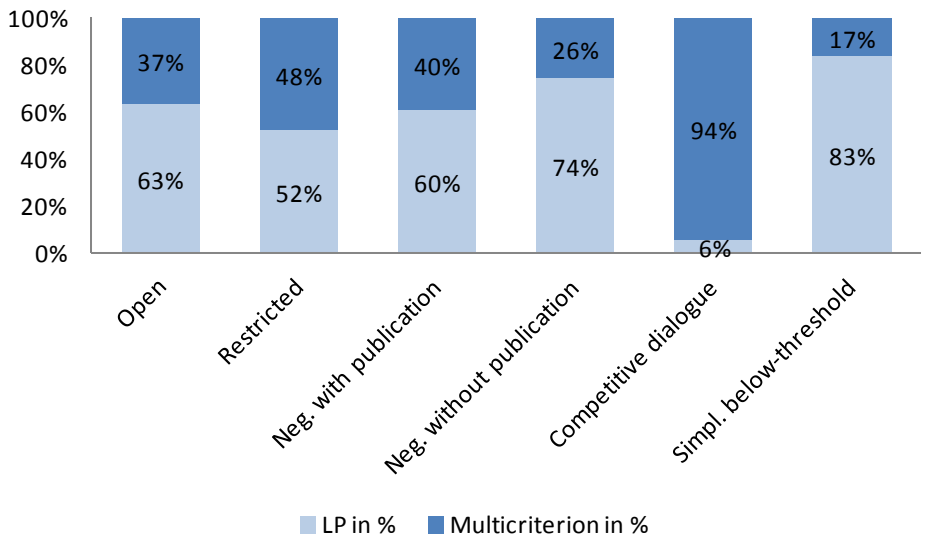


Source: author's calculation

6.2.2 Effect of type and subject of procurement on the selection process

The Act defines six types of procurements (open, restricted, negotiation with publication, negotiation without publication, competitive dialogue and simplified below-threshold procedure). More than a half of all contracts (51 %) have been awarded through an open procedure using lowest price criterion in 63 % of cases. The open procedures are followed by negotiation with publication and negotiation without publication, awarding 18 % and 16 % of all contracts respectively. In both of these procedure lowest price criterion is preferred with 60 % and 74 % respectively. The only procedure where share of MEAT selection process beats lowest price criterion is competitive dialogue but its share among all contracts' awarding procedures is insignificant (around 0,04 %).

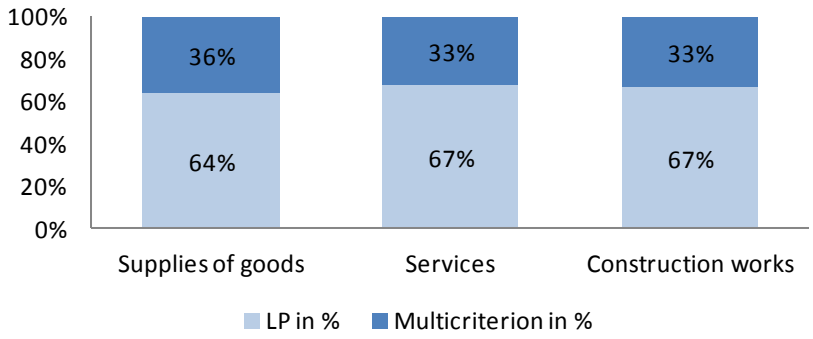
Figure 10: Lowest price criterion among different procedure types of procurement



Source: author's calculation

According to the Act, there are three categories of public procurement based on the subject of procurement (supplies of goods, services and construction works). Both, their share on all contracts awarded, 31 % of supplies of goods, 33 % of services and 33 % of construction works and the proportion of lowest price criterion in the selection process in all three categories, are very similar. Lowest price criterion is preferred to MEAT selection as it covers on average 66 % of all contracts awarded.

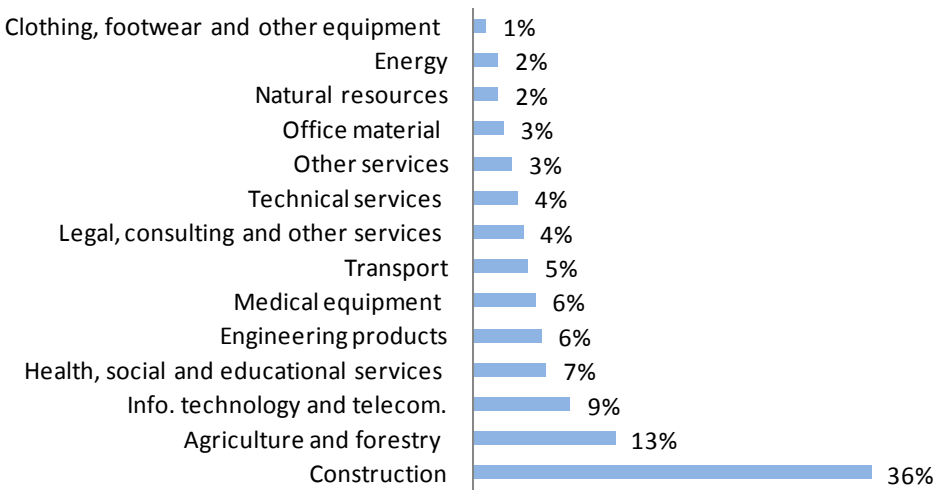
Figure 11: Lowest price criterion among different subjects of procurement



Source: author's calculation

Subject of procurement is defined across the whole European Union uniformly using CPV (Common procurement vocabulary) codes. They define various categories of procurement contracts through a single classification system and therefore the references used by contracting authorities are standardised. In the Czech Republic, more than one third of all contracts belong among construction category, followed by agriculture and forestry with 13 % and information technology and telecommunications with 9 %. The remaining contracts are distributed among other categories; the precise share of various categories is presented on the following table.

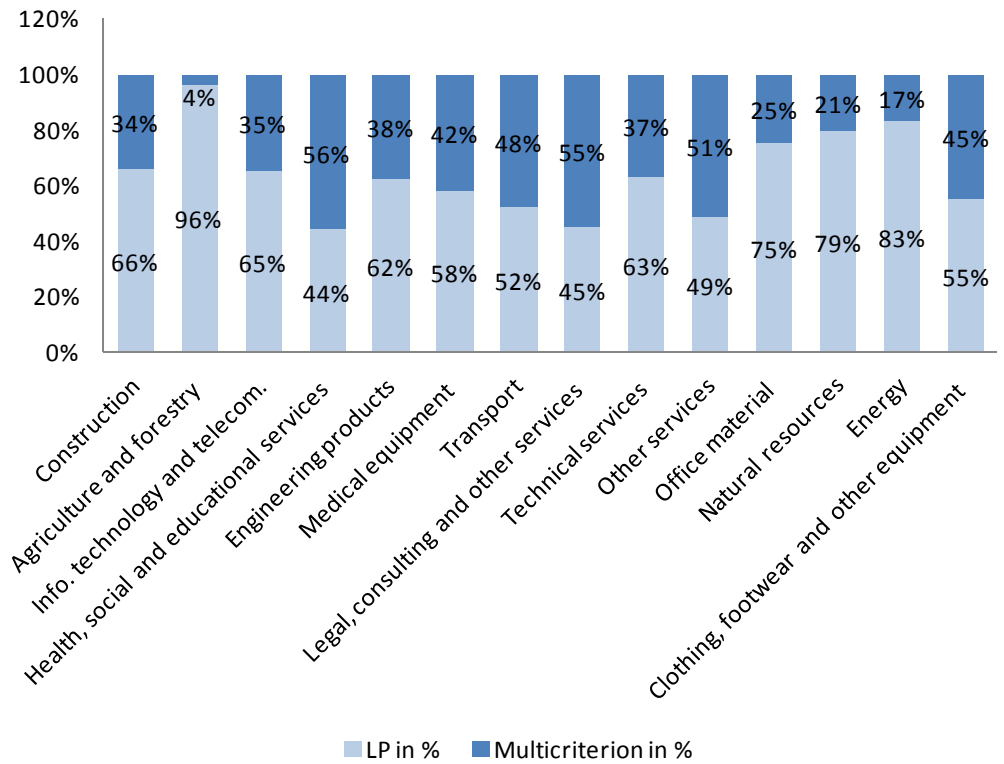
Figure 12: Proportion of contracts' categories in all contracts awarded



Source: author's calculation

The proportion of lowest price criterion is very diverse within different categories. In the very specific categories, such as health, social and educational services and legal, consulting and other commercial services, contracting authorities prefer MEAT selection process. Whereas in all other categories, lowest price criterion is presented in more than a half of awarded contracts. In agriculture and forestry, lowest price criterion absolutely beats MEAT selection process. Almost all contracts in this kind of industry are tendered on the lowest price criterion.

Figure 13: Lowest price criterion among different sectors



Source: author's calculation

6.2.3 Intervention of OPC and extraworks

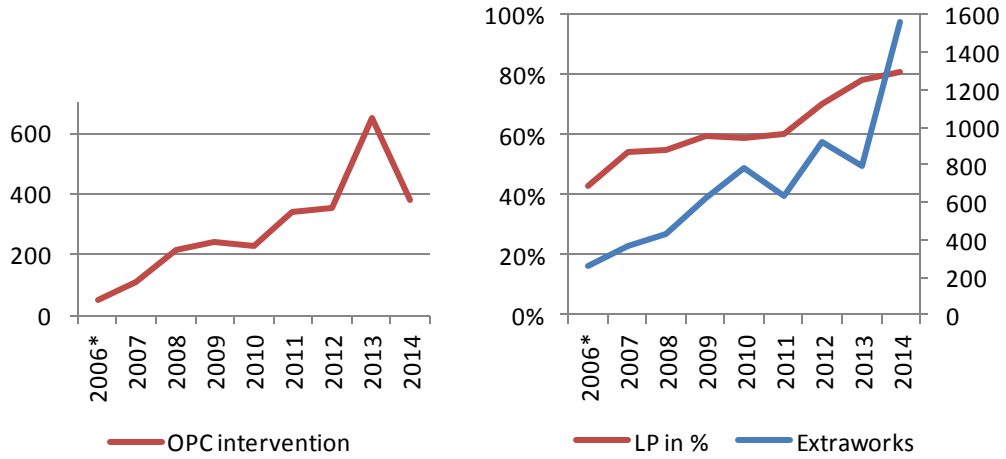
Within the years 2006 and 2014, there were around 4 851 interventions by OPC[3], from which 2 217 interventions were related to our studied public procurements. In general they covered reviewing the actions and exercising supervision over behavior of contracting authorities from discrimination through setting specific technical criteria to the whole administration process (evaluation of bids, selection and fulfilment of all necessary procedures settled by the Act before and after signing the contract). Within the last years, the trend of intervention was increasing. Since

[3] http://www.uohs.cz/cs/verejne-zakazky/sbirky-rozhodnuti.html

2006, number of interventions continued to rise smoothly till 2012 when there were around 649 of interventions. The activity of OPC decreased to 377* interventions on procurements assigned in 2014[4]. In the last years, the processs of public procurements has been publicly attractive, so OPC is also putting effort on the effective control and supervision.

The trend of extraworks has also an increasing character in the last years. In 2007, there were around 256 contracts awarded defined as extraworks whereas two years later, the number has almost doubled to 433. In the following years it continued to rise as well, untill 2014 when there were around 1 560 of extraworks awarded.

Figure 14: The trend of OPC interventions, extraworks and lowest price criterion 2006 – 2014



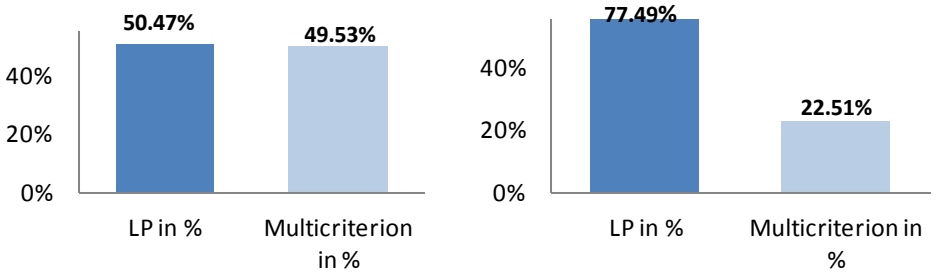
Source: author's calculation

We use these two phenomenons, OPC interventions and extraworks to study the effect of specific selection critertias. The proportion of public procurements by the selection process reviewed by OPC is described in the following figure. In total numbers, the interventions are divided evenly between procurements with lowest price criterion and MEAT selection process. Due to the fact that OPC interventions were presented mainly in the recent years when just around one quarter of procurements were contracted based on the MEAT selection criteria, the probability of OPC intervention in procurement with MEAT selection process is four times higher then the probability of lowest price criterion.

[4] Data available in April 2015 were used for an analysis. Due to the complex and long lasting process of OPC intervention, the number of actual interventions in certain years might be slightly different.

The second studied effect of lowest price criterion as the only selection criterion is a phenomenon of extraworks. Second figure represents proportion of selection processes in extraworks awarded. While using an institute of extraworks, procurers prefer lowest price criterion significantly more (three quarters of all extraworks have been awarded based on the lowest price criterion). This fact is also supported by the type of procurement, negotiation without publication, through which extraworks are usually awarded and which is preferably awarded by the lowest price criterion.

Figure 15: OPC intervention and extraworks

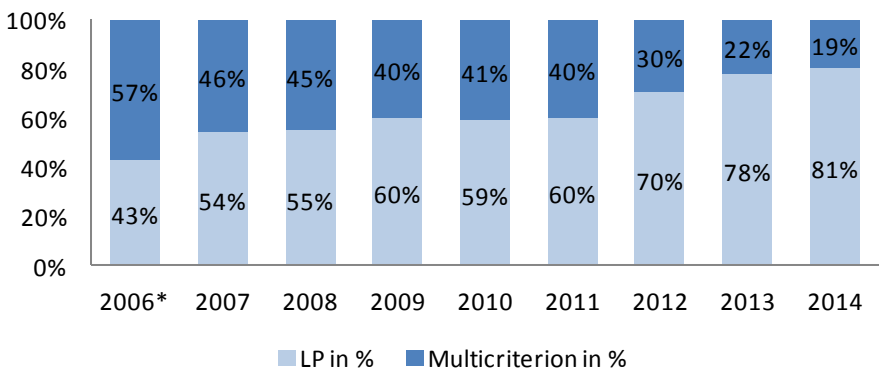


Source: author's calculation

6.2.4 Trend of the selection process since 2006

In 2006* around 43 % of all contracts were tendered using the lowest price criterion. Although, the data on awarded contracts in 2006 are studied just for the second half of the year because official data started to be collected since June 2006. Eight years later, the share of these contracts was doubled to 81 %. Contracting authorities started to prefer lowest price criterion to the MEAT in the selection processes. In the following section, we will study and identify the drivers of choosing lowest price criterion as the selection criterion and we will try to identify effects and stability of the specific contracts.

Figure 16: Trend of using lowest price criterion from 2006 to 2014



Source: author's calculation

6.3 Hypotheses and specification of the models

The aim of this empirical evidence is to identify determinants of various selection processes and to identify their effects on the actual dataset of public procurements. The presented analysis is based on the estimation of regression equations which are designed in the logic of the tested hypotheses applied on the above described dataset. The preceding graphs and the practical experience suggest that various selection criterias have different drivers and effects. In general, MEAT selection criteria is connected with relatively higher risks, administratively more difficult selection process and also more difficult and complex preparation of bids on the side of bidders. Procurers therefore prefere lowest price criterion which is considered as administratively easier and less risky in terms of consequential potentional interventions by OPC. But it does not have to be necesarly the best criterion, in some cases MEAT selection process is rather recommended due to the specific characteristics of contracting subject. Based on the best practice and latest development of the public procurements, we have decided to study the following hypotheses:

Hypothesis H1: Lowest price criterion is negatively correlated with number of employees of contracting authority. Larger institutions, with more employees, prefer MEAT selection due to their available resources for more sophisticated selection procedure.

Hypothesis H2: Number of bidders is positively correlated with lowest price criterion.

Hypothesis H3: Lowest price criterion leads to different market composition, different firms in terms of number of employees compete in public procurements with lowest price criterion comparing to those with MEAT selection.

Hypothesis H4: Public procurements with the lowest price criterion face less OPC interventions than those with the MEAT selection.

Hypothesis H5: Specific selection criteria lead to the consequent public procurement tendering or extra contracts.

Each hypothesis sets a model which attempts to explain the drivers and the effects of lowest price criterion as a function of characteristics of contracting authority (its institutional form, number of employees) and characteristics of procurement procedure (type of procedure, number of bidders, estimated price). In most cases the

variables are expressed as dummy variables (stated as D in the following models). For an analysis, the econometric method OLS is used in order to clean the models from other external effects. The models are described as follows:

<u>Model 1:</u> $D\_LP = \alpha + \beta_1 \, logestimated\ price + \beta_2 \, D\_procurer + \beta_3 \, procurer\ based\ on\ the\ employees + \beta_4 \, D\_procedure + \beta_5 \, D\_industry + \beta_6 \, D\_year + \beta_7 \, D\_EU\ funding * D\_year + \beta_8 \, D\_administrator + \beta_9 \, D\_EU\ funding + \beta_{10} \, D\_EU\ funding * D\_administrator + \beta_{11} \, D\_overlimit * D\_administrator + \varepsilon$

<u>Model 2:</u> $Bidders\_count = \alpha + \beta_1 \, logestimated\ price + \beta_2 \, D\_LP + \beta_3 \, D\_procedure + \beta_4 \, industry + \varepsilon$

<u>Model 3:</u> $Supplier\ based\ on\ the\ employees = \alpha + \beta_1 \, logestimated\ price + \beta_2 \, D\_LP + \beta_3 \, D\_procedure + \beta_4 \, bidders\_count + \beta_5 \, D\_industry + \beta_6 \, D\_EU\ funding + \varepsilon$

<u>Model 4:</u> $D\_OPC\ intervention = \alpha + \beta_1 \, logestimated\ price + \beta_2 \, D\_procedure + \beta_3 \, D\_industry + \beta_4 \, D\_year + \beta_5 \, D\_LP * year + \beta_6 \, D\_administrator + \beta_7 \, D\_EU\ funding + \beta_8 \, D\_EU\ funding * D\_administrator + \beta_9 \, D\_sublimit * D\_administrator + \varepsilon$

<u>Model 5:</u> $D\_extraworks = \alpha + \beta_1 \, logestimated\ price + \beta_2 \, D\_LP + \beta_3 \, D\_industry + \beta_4 \, D\_year + \beta_5 \, D\_administrator + \beta_6 \, D\_EU\ funding \quad \varepsilon$

Where:

- Dummy variable “LP” represents a binary variable of selection process of public procurement, it differentiates between lowest price criterion and MEAT selection.

- Variable “logestimated price” represents estimated price of public procurement and controls then the size of the procurement.

- Dummy variable “procurer” determines eight types of procurers (natural person, private enterprise, municipality, contributory organization, public administration, public enterprise, university or research institution and health insurance company).

- Independent variable “procurer based on the employees” determines the size of the procuring authority according to the number of employees. We use a linear function of number of employees of procurers.

- Dummy variable "procedure" is a set of dummies representing specific type of procedure (open, restricted, negotiation with publication, negotiation without publication, competitive dialogue and simplified below threshold).
- Dummy variable "industry" represents a set of dummies for industry specification. Using the so-called CPV-2 level, two digit common procurement vocabulary (CPV) determined by European Commission (2008), there are different CPV groups based on the subject of procurement.
- Dummy variable "year" represents binary variable for the specific year of awarding a contract based on the public procurement.
- Dummy variable "EU funding" represents a binary variable for the case when the awarded contract is financed from EU structural funds.
- Dummy variable "administrator" represents binary variable for the case when the awarded contract has been administrated by external administrators.
- Dummy variable "overlimit" represents a binary variable for sublimit or overlimit procurements, determined by the estimated price of procurement.
- Dependent variable "bidders_count" covers number of bidders in the public procurements.
- Dependent variable "supplier based on the employees" determines the size of supplier according to the number of employees. We use a linear function of number of employees of suppliers.
- Dummy variable "OPC interventon" represents binary variable for the case when an intervention by OPC was launched against the administration of the process of public procurement.
- Dummy variable "extraworks" determines procurements which were awarded as extraworks.

First model focuses on the determinants of the lowest price criterion with specific focus on the size of contracting authority. The following models focus on the effects of lowest price criterion as a selection criterion.

Second model examines the determinants of number of bidders in public procurement. Specifically, an effect of concrete selection criterion on number of bidders is estimated, controlling for other characteristics of the procurement, such as type of procurement, estimated price and specific industry. Third model studies the

effect of lowest price criterion on different market composition and forth model examines the probability of OPC intervention based on specific selection criterion and other characteristics of the procurement. The last model is aimed to determine the effect of lowest price criterion on extra tendering through extraworks.

In order to process an analysis, classical OLS estimation was used for Model 2 and 3 and as the dependent variables in Model 1, 4 and 5 are binary variables whose range of values is substantially restricted (coded either with 1 or 0 depending on the specification of the variable) they require a specific treatment. In econometrics, there are often used several types of models to estimate the parameters of binary dependant models. The method which uses the OLS is called the linear probability model (LPM). Also more sophisticated models are given by logit and probit models which both apply a technique of maximizing log-likelihood function (Wooldridge, 2006).

The estimated effects in the models are quite straightforward; we just have to make sure that the models are correctly settled due to the identification problems. Each explanatory variable can affect dependent variable and the reversed causality is not possible. The process of public procurement is clearly defined. First the procurer selects type of procurement in terms of subject, procedure and selection criteria. Then there is a period of accepting bids and at the end, the best bid is chosen. The process cannot be reversed so neither number of bidders, nor final supplier can influence specifications of procurement process.

6.3.1 LPM, probit and logit models

A key idea of all three methods is to transform the dependent binary variable into a probability of presence of certain state (in our case lowest price criteria, OPC intervention or extraworks). The first model, LPM defines this probability as a linear function of other independent variables:

$$P(y = 1|x) = \propto + \sum_{i=1}^{n} \beta_i x_i$$

where y is a dependent binary variable, α is a constant and β_i are coefficients of explanatory variables x_i. Through LPM we can easily identify potential factors that may influence an occurrence of an analyzed state. Its main advantage comparing to probit and logit models is an easy interpretation. According to the signs of coefficients, we can immediately determine their effect and due to the linear nature of a function we can also estimate the magnitude of this effect. Nevertheless, it has two main shortcomings. In general, the fitted probability can exceed one or be lower than

zero and the partial effect of any explanatory variable in level form is constant (Wooldridge, 2006). The first case is more important for our models since it happens when the sum of all estimated parameters is greater than one and the quantitative explanatory variables even increase the probability with each additional unit if their coefficients are positive. The probability of our studied phenomenon is then higher than one which is not statistically possible. This method will be used to get at least approximate estimators and signs of coefficients but it will be completed with other, more sophisticated method for robussness check where it is not possible to overrun probability of zero or one.

More sophisticated methods are probit and logit models which instead of estimating a probability through a linear function, estimate a completely new function reaching values between zero and one using a linear original function as its internal function. Logit model applies the cumulative distribution function for a standard logistic random variable whereas probit model uses standard normal cumulative distribution function. The basic equation for the logit and probit models is as follows:

$$P(y = 1|x) = G(\propto + \sum_{i=1}^{n} \beta_i x_i)$$

where y is a dependent binary variable, α is a constant, β_i are coefficients of explanatory variables x_i and G(.) is an external function strictly taking values between zero and one for all real values of z. In the logit and probit models, respectively, the external function G(.) is expressed by following formulas:

$$G = \frac{\exp(z)}{1+\exp(z)} \quad and \quad G = \int_{-\infty}^{z} \frac{\exp\left(\frac{-z^2}{2}\right)}{\sqrt{2\pi}} dz$$

where z is an internal function defined in the previous equation.

The shortcoming of these two methods is their difficulty of interpretation due to nonlinear nature of the external function. The only clear interpretation is an effect according to the signs of coefficients. Comparing these two models, logistic regression is used more often as the model is easier calculated due to the nature of the function but assumption of standard normal distribution in the probit model is more realistic and probit model is therefore preferred by economists (Wooldridge, 2006).

6.3.2 Estimation procedure of Model 1

For analysis of Model 1, two econometric techniques were used to estimate the binary dependent model. First, we use linear probability model (LPM), while the second one is probit model for comparism and robustness check. As shown in the results part later, the coefficients and corresponding significance levels are quite consistent for both methods.

First, model LPM was estimated by ordinary least squares. Breush – Pagan test of homoskedasticity of residuals rejected the null hypothesis of homoscedastic residuals (Prob > $\chi^2 = 0{,}00$). The LPM for a binary dependent variable has very often heteroskedastic error terms (Wooldridge, 2006). So we have applied Huber-White adjusted errors to the estimation of model to deal with this problem. The null hypothesis of normally distributed residuals was rejected by Shapiro – Wilk test (Prob > z = 0,00). We will later apply also probit model for comparism of results but so far we can conclude that our dataset is sufficiently large and our estimators satisfy at least asymptotic normality. The collinearity and multicollinearity do not occur in this model (Mean VIF = 4,95). The advantage of LPM estimation is that our results determine the effects of the explanatory variables through signs of their coefficients and the approximate magnitude as the probability is linear in parameters β_i. In probit model, the partial effects of explanatory variables on using lowest price criterion have always the same signs as the estimated coefficients. But due to the nonlinearity we cannot immediately determine the magnitude of their effects.

The full results from estimation of LPM and probit model are presented in the table in Appendix A. The estimated parameters of each variable are always in the first row and number of stars represents the level of significance (5%, 1% and 0,1%) for a parameter equaling zero. The t and z statistics are presented in parentheses for LPM and probit model, consequently. As the estimated coefficients of LPM are both positive and negative, we cannot reject a possibility that the estimated probability of dependent variable (lowest price criterion) can be lower than zero or exceed one. And due to nonlinearity of the probit model, coefficients' estimates do not determine the effect of explanatory variables directly (Aldrich, 1976). So we will focus on the effects rather than their magnitudes.

Looking at the results of both methods, it is clear that the coefficients for both models are quite similar and they are all consistent within the signs of coefficients. In both models most of the explanatory variables are significant. A base group for dummy variable type of procurer was chosen a private enterprise. Comparing to this base group all types of public procurers (municipality, contributory organization, public

administration, public enterprise and university) have a positive effect on the probability of using lowest price criterion in selection process. Only insurance companies lower the probability of this type of selection process criterion and they prefer MEAT selection. The effect can be explained by the principal-agent problem when agent is hired by principal but the incentives between those two are not perfectly aligned. Stoker (1998) suggests a result that the agent may be tempted to act in his or her own interest rather than principal's. In our case, public procurers as agents bear the full cost of putting effort into the task of administrating public procurements but they do not receive the full benefits, so they rather prefere less sophisticated selection criteria which is administratively easier and less risky. Public enterprises usually pursue goals different from profit maximization and a problem of asymmetric information is presented as well. In classical enterprises, agents are familiar with the cost and benefit structure of the company so they are more gain-oriented. However, elected or appointed officials work just with determined state budget structure. They also miss the bonus or profit-sharing motivation schemes which are typically used to resolve the principal-agent problem. For Czech public sector, the fixed wage system is typical, employees receive a salary equaling to the marginal revenue product of the average employee so in roles of agents they are not motivated to maximize productivity.

Comparing the types of procurers according their number of employees, it is expected that larger procurers would prefer MEAT as a selection procedure due to their available resources. But the opposite effect has been concluded, an increasing size of procurer in terms of number of employees increases the probability of using lowest price criterion. The result can be explained by the fact that big public institutions have very complicated system of administration where it usually takes a lot of time to take any decisions. So they rather prefer administratively less complicated selection criterion in public procurements to finish them faster and decrease the probability of having any kind of problems due to badly defined or badly evaluated criteria in MEAT selection process. This phenomenon can be also explained by the principle-agent problem when due to the size and complexity of bigger contracting authorities, agents prefer using less complicated and risky selection criterion.

Studying the effect of a type of procurement we have used an open procedure as a base group. It was found out that less transparent types of procurements such as negotiation with publication, negotiation without publication and simplified below-threshold procedure increase the probability of using lowest price criterion. Other types of procedures, such as restricted procedure and competitive dialogue decrease the probability of using the lowest price criterion. In procedures such as negotiation

with publication and negotiation without publication, the procurer controls the quality criterias of the bidders through determining their qualification so lowest price criterion selection is the most efficient type of selection. In simplified below-threshold procedure, the value of the subject of procurement is rather smaller, so procurers prefere to apply less complicated selection process. As Palguta and Petold (2015) found out those procurers manipulate anticipated value of procurements in order to fulfill the threshold for simplified below-threshols procedure. In other words, procurers prefere easier and administratively less complicated procurement processes and they are willing to manipulate estimated price to get them. This result is in line with our results, procurers prefere to easy the administration of procurements and we can conclude that using less transparent procedures lead also to preference of lowest price criterion.

Controling for more sectoral specfications, industry is identified in terms of the so called CPV-2 level codes, using the first two digit common procurement vocabulary (CPV) codes. Data suggest that public procurement of more homogeneous subject such as agriculture, office material, natural sources and energy increase the probability of using lowest price criterion. In case of public procurements of more specific subjects such as health and legal services, engineering products, medical equipment and transport, procurers prefer MEAT selection procedure over lowest price criterion. The estimation supports this hypothesis, and therefore we can conclude that in procurement with more homogenous goods, such as agriculture and energy, procurers prefere lowest price criterion.

In line with the results of study of Janský, Křehlík and Skuhrovec (2015), a significant increasing trend over last years in use of lowest price criterion has been detected. Significantly more tenders by 25,7% have been awarded in 2014 than in 2007 based on lowest price criterion (Janský, Křehlík & Skuhrovec detected similar difference of 25%) whereas the effect of procurements subsidized from EU funds is even stronger. From 2007 to 2014, increasing number of tenders financially supported by EU funds have been awarded based on lowest price criterion.

Table 4: Time trend of using lowest price criterion

Year	Year dummy (LPM)	EU funding * year dummy (LPM)
2007	0.073***	-0. 185***
2008	0.104***	-0. 153***
2009	0.090***	-0. 055*
2010	0.096***	0. 014

2011	0.184***	-0. 103***
2012	0.264***	-0. 048*
2013	0.332***	0. 016
2014	0.360***	0. 022

Note: Year 2006 has been used as a base year.

Source: author's calculation

As Janský, Křehlík and Skuhrovec (2015) explain, the trend might be connected to the fiscal crisis and to tightening of audit measures, especially in case of projects funded by EU.

We have also studied an effect of external administrator in the process of public procurement. The presence of administrator is statistically significant in two cases, in case of contracts financed by EU and in overlimit procurements. The results is in line of risk averion of public institutions defined by Stoker (1998) who suggests that in order to fulfill settled tasks and due to lack of internal resources, organization hire or contract another parties. In our scenario of public procurements, procurers prefere external administrators in case of contracts financed by EU which are highly exposed to the control of auditors and overlimit public procurements which are administratively more complicated. In contracts finaced by EU, the presence of external administrator increases the probability of using lowest price criterion whereas in overlimit procurements, MEAT selection is preferred.

Table 5: Efffect of external administrator

	Sublimit procurement	Overlimit procurement
EU funding	0,056***	-0,041***
Non EU funding	-0,126***	-0,149***

Note: External administrator is presented in all four cases.

Source: author's calculation

In conclusion, based on the estimation, we can say that selection criteria depend on type of procurer and type and subject of procurement. Public contracting authorities and larger procurers in terms of number of employees prefer lowest price criterion. So we can reject our hypothesis that lowest price criterion is negatively correlated with number of employees of contracting authority. It was expected that larger institutions, with more employees, prefer MEAT selection due to their available resources for more sophisticated selection procedure. In reality, an opposite effect is presented; larger institutions increase a probability of using lowest price criterion. The reason is principle-agent problem and information asymmetry. Moreover, we

have detected an increasing trend of using lowest price criterion over the last years, which is even stronger in case of contracts financed by EU. Also an effect of external administrators is presented, procurers prefere using external administrators in two cases, when contract is financed by EU and when contract is considered as overlimit procurement which is administratively more difficult. When the process is administrated by external administrator, lowest price criterion is preferred in sublimit contracts financed by EU whereas in overlimit procurements, MEAT selection is used more often.

6.3.3 Estimation procedure of Model 2

To estimate the parameters in Model 2, we have used classical OLS estimation. First, standard tests available in STATA were performed in order to verify the linear regression assumptions needed to provide best unbiased estimators in the regression. Homoskedasticity assumption was tested by a combination of visual analysis of residuals plot and Breush–Pagan test. Normality assumption was verified using Sharpo-Wilk test and an absence of multicollinearity was tested by variance inflation factor. Inclusion of all relevant variables was tested by the Ramsey RESET test. All tests' results and conclusions on fulfilment or failing the assumptions can be found in the Appendix B.

The analyzed relationship in Model 2 is an effect of the lowest price criterion on number of bidders controlling for other explanatory variables. The dependent variable is given by the number of bidders. The independent variables are given by estimated price of a contract, dummy variable of selection process (1 coded for lowest price criterion and 0 coded for MEAT selection process), dummy variables for a type of procurement in terms of type of procedure and subject of procurement. In each tested characteristic, one dummy variable was excluded in order to avoid the dummy variable trap by introducing perfect collinearity. Then we can interpret the coefficients on all dummy variables describing procurement method, in accordance with the base group. We expect variable of lowest price criterion to have positive coefficient as it is generally believed and it has been already proved by Pavel (2008) that procurement with this type of selection process is considered to be more transparent. The estimated price is an important motivating indicator for bidders and its effect should theoretically have a positive coefficient as well. Coefficients of dummy variables for different types of procurement methods are expected to be negative as the open procedure is viewed as the most transparent and the most trustworthy procedure for bidders. The coefficients of industry specifications will be determined by the estimation.

The results from models estimation are summarized in Appendix C. As heteroskedasticity was detected, robust standard errors were applied in the estimation. The second column in the table represents estimation with stricter assumption of dependence within clusters of procurers as our studied dataset consists of several procurements which have been undertaken by the same procurers.

After model estimation with standard errors, almost all coefficients of explanatory variables are significant and therefore we can interpret their effects on number of bidders. We have also tested an overall significance of variables defining type of procedure and subject of procedure. Using an F test both hypothesis of joint zero coefficients and therefore no effect on the dependent variable were rejected on the 5 % significance level (Prob > F = 0 in both cases). The coefficient of determination R-squared indicates that around 19,53 % of the variation in number of bidders is explained by variations in explanatory variables.

The tested Hypothesis 2 is that lowest price criterion leads to stronger competition in terms of number of bidders in the procurement. We run the t-tests and look at the p-values. As the p-value for a dummy variable of a selection criterion is very low, we cannot reject the hypothesis that there is a relationship between lowest price criterion and number of bidders controlling for other variables. Moreover since its coefficient is positive, the number of bidders is higher in procurements with lowest price criterion on average by 0,5 bidders. The effect can be explained by the fact that bidders consider procurements selected based on the lowest price criterion more transparent and less administrativly demanding in terms of preparation their bids. The conclusion is in line with result of Vyklicky (2013) who concluded that cost intensity in the processing of tenders prevents suppliers to submit their tenders for public contracts. That creates a relevant trade off between the simplicity of the process leading to higher competition and evaluating the quality of offered goods or services.

Taking into account the estimated price, there is a positive relationship between the estimated price and number of bidders so procurements with higher estimated price have on average more bidders. Comparing various types of public procurement and their effect on the number of bidders we can conclude that open procedure is the most tempting procurement for suppliers. All coefficients of dummy variables defining other types of procurement procedure are negative which means that using those types of procedures leads to lower number of bidders on average by 1,9 bids. Analysing the subject of procurement, it appears that procurements oriented on agricultural products and services, public utilities, construction works and services

are the most tempting for suppliers and they increase an average number of bidders by about 3,4; 0,45 and 2,3, respectively.

Relaxing an assumption of independence and taking into account specific procurers, the results are consistent and we can conclude the same effects as in the first estimation with robust standard errors. It indicates that competition expressed by number of bidders is dependant on estimated price, type of procurement and selection procedure and varies across different industries.

To conclude, the more open and transparent the procurement procedure is settled and the higher the estimated price is, the higher is the number of bidders and therefore the higher is competition. We have found empirical evidence that number of bidders is positively correlated with the lowest price criterion and therefore we cannot reject our hypothesis that there is a relationship between those two characteristics of procurement.

6.3.4 Estimation procedure of Model 3

For estimation of Model 3, we have used classical OLS estimation. First, similarly to estimation of Model 2, standard tests available in STATA were performed in order to verify the linear regression assumptions. All tests' results and conclusions on fulfilment or failing the assumptions can be found in the Appendix B.

Analyzed relationship in Model 3 is an effect of the lowest price criterion on different market composition of winning firms in terms of number of their employees, controlling for other explanatory variables. The dependent variable is given by the number of employees of suppliers. The independent variables are given by estimated price of a contract, dummy variable of selection process (1 coded for lowest price criterion and 0 coded for MEAT selection process), dummy variables for a type of procurement in terms of type of procedure and subject of procurement and a dummy variable of a contract subsidized by EU funds. The same as in the estimation of Model 2, in each tested characteristic, one dummy variable was excluded in order to avoid the dummy variable trap by introducing perfect collinearity.

The results from estimation are presented in the table in Appendix D. The same effect of heteroskedasticity was detected by Breush-Pagan test, so robust standard errors were applied in the estimation. The second column in the table represents estimation with stricter assumption of dependence as our studied dataset consists of several procurements which have been undertaken by the same procurers.

The tested Hypothesis 3 is that lowest price criterion leads to different market composition. Different firms in terms of number of employees compete in public procurements with lowest price criterion comparing to those with MEAT selection. We run the t-tests and look at the p-values of estimation. As the p-value for a dummy variable is relatively low, we cannot reject a hypothesis about relationship between lowest price criterion and specification of supplier in terms of number of employees controlling for other variables. Moreover since its coefficient is positive, in procurements with lowest price criterion larger companies on average by 24,4 employees win the contracts.

According to the estimated model, contracts with higher estimated price are awarded to suppliers with higher number of employees. Also other characteristics of public procurement procedure determine the type of supplier. In general, more open and transparent procedures lead to larger suppliers in terms of number of employees. In a case of more restricted procedures such as negotiation with publication and simplified below - threshold procedure, rather smaller companies whose number of employees decreases by 34,92 and 41,2 employees, respectively, win the contracts. In negotiation without publication where just one bidder, final supplier is presented, larger companies are prefered. Number of employees increases by around 114,6 employees comparing to average companies winning open procedures. Very interesting is a significant effect of contract financed by EU which decreases number of employees by 16,5. It means that in procurements cofinanced by EU, rather smaller firms win the contracts. Effect of type of procurement in terms of subject of procurement is significant as well and they vary significantly controling for sectoral specifics. The largest firms in terms of number of their employees win contracts oriented on construction works, postal and telecommunication services, finance and insurance, research and development and related consulting services. This phenomenon can be explained by the fact that firms competing in these sectors are rather larger.

In order to fully analyse market differentiation in procurements awarded based on lowest price criterion and MEAT selection, we have studied afrequency distribution of specific suppliers. We have counted for each supplier (14 748 identified Czech firms in our dataset) a rate of procurements won based on the lowest price criterion and we studied their frequency distribution. Based on our hypothesis, we expected inconsistent market composition and therefore ununiform distribution. As we can see on picture in Appendix D, the actual distribution of firms winning procurements based on the lowest price criterion is not uniform, there are two peaks. First peak at zero represents a frequency when suppliers win procurements awarded only based on

MEAT selection and the other one, at one, represents a frequency of contracts won only based on the lowest price criterion. Therefore we cannot reject the hypothesis that lowest price criterion leads to different market composition.

In conclusion, we can say that our hypothesis about different market composition in terms of supplier size due to different selection procedure cannot be rejected. We have found out that lowest price criterion increases a probability of having a supplier with larger number of employees and the actual effect is incosistent in various types of sectors. We can also conclude that size of supplier is affected by type of public procurement in terms of both, procedure and subject.

6.3.5 Estimation procedure of Model 4

Similar to the analysis of Model 1, for estimation of Model 4, specific econometric techniques were used to deal with binary dependent model. The first one is LPM, while the second one is probit model as a robustness check. As shown in the results part later, the coefficients and corresponding significance levels are quite consistent for both methods.

First, we applied an estimation using LPM. Standard tests available similar to those performed while estimating Model 1 were used in order to verify the linear regression assumptions and the results were similar. As Breush – Pagan test of homoskedasticity of residuals rejected the null hypothesis of homoscedastic residuals (Prob $> \chi^2 =$ 0,00), we used Huber-White adjusted errors to the estimation.

The estimated results of Model 4 are shown in the table in Appendix E, the LPM is in the first column and probit model is in the second one. Parameters of each variable are always in the first row and number of stars represents the level of significance (0,1%, 1% and 5%) for a parameter equalling zero. The t statistics are presented in parentheses for LPM and z statistics for probit model. Due to the characteristics of the models, we will focus on the effects rather than their magnitudes.

We have studied a hypothesis that public procurements with different selection criteria face OPC interventions with different probability. In other words, that public procurements awarded based on the lowest price criterion are more stable in terms of OPC interventions. We have identified procurements which were brought to OPC investigation and used them as dependent variable. The independent variables than characterize public procurement in terms of estimated price, type of procedure, industry, presence of external administrator and EU founding. We have also included time trend to study the hypothesis of increasing OPC interventions over the last years.

The signs of coefficients and corresponding significance levels are quite consistent using both methods, LPM and probit model. As a base group for type of procurement we have used open procedure. It was found out that only restricted procedure increases a probability of OPC intervention whereas all other types of procedure decrease this probability comparing to the open procedure. Controling for sector specifics, the effects are various. More prone to interventions are sectors such as medical, security and defence equipment, transport, defence, agriculture and education services. Whereas sectors, such as energy and financial and insurance services are more stable in terms of the probability of OPC intervention.

We have also detected a significantly increasing trend over the last years in OPC interventions which is presented in the following table. More tenders have been intervened in 2014 than in 2006 by almost 2%. This phenomenon can be explained by increasing competitive struggle among firms operating in the same industry and their aim to get more contracts awarded through public procurements. Another factor is tightening of audit measures and increasing pressure of controlling mechanisms. The cross products of yearly dummies and lowest price criterion show no particular trend but we can conclude that all significant coefficients are negative, so the effect of lowest price criterion on the probability of OPC intervention is negative as well. The OPC interventions have 1-2 % smaller probability in case of lowest price criterion than MEAT seletion in the recent years. The trend suggests that procurements awarded based on the MEAT selection process are more susceptible to OPC interventions than those awarded based on lowest price. The difference is than caused by particular selection process and the established selection criteria. Procurers have to deal with two risky steps, first setting up the selection criteria and than evaluating the bids according to the criteria and select the best bid proposed. These two steps are very risky due to potential misconducts of the procurers in the administration process which may eventually lead to OPC intervention.

Table 6: Time trend in OPC intervention

Year	Year dummy (LPM)	LP * year dummy (LPM)
2007	-0.005	-0.006*
2008	-0.001	0.005
2009	0.002	-0.005
2010	-0.002	-0.002
2011	0.007*	0.005
2012	0.016***	-0.008*
2013	0.015***	-0.019***

2014	0.019***	-0.017***

Note: Year 2006 has been used as a base year.

Source: author's calculation

We further focused on effect of external administrator which is significantly positive. The results show that public procurements which are administrated by external subject rather than contracting authorities are more prone to OPC intervention. We also included variables defining whether awarded contract is financed by EU and whether it is sublimit or overlimit procurement based on the estimated price. The following table shows the respective coefficients. We can conclude that contracts administrated by external administrator are in general more prone to OPC interventions and out of which, non EU funded overlimit public procurement are the most prone to OPC intervention. In general EU founded and sublimit procedures are more stable in terms of OPC interventions than non EU founded and overlimit procedures administrated by external administrator, respectively. The question which arises then is why procurers hire external administrators if procedures administrated by them are significantly more prone to OPC interventions. The answer might be risk aversion of public procurers which leads them to choose apparently safer procurement process and preference to transfer the responsibility on the third parties.

Table 7: Efffect of external administrator

	Sublimit procurement	Overlimit procurement
EU funding	0,012***	0,046***
Non EU funding	0,028***	0,062***

Note: External administrator is presented in all four cases.

Source: author's calculation

In conclusion, we can say that public procurements awarded according to the lowest price criterion bear smaller legal risk related to possible OPC interventions than those with the MEAT selection. OPC interfere more in case of restricted and open procedures than other types of procedure of public procurements and in a case of overlimit procedures administrated by external administrator. One of the reason is definitely a type of procurement itself, restricted and open procedure have usually more bidders and therefore more potentional complainants, whereas in a procurement such as negotitation without publication there is only one bidder, final supplier. In case of external administrator, public procurers established risk aversion and prefere tranfering responsabilities on external administrators even if their presence just increases the probability of OPC intervention.

6.3.6 Estimation procedure of Model 5

For estimation of Model 5, LPM and probit model were used as well to deal with binary dependent model. Similar to the previous analysis, coefficients and corresponding significance levels are quite consistent for both methods.

First, we applied an estimation using LPM. Standard tests available similar to those performed while estimating Model 1 were used in order to verify the linear regression assumptions and the results were similar. As Breush – Pagan test of homoskedasticity of residuals rejected the null hypothesis of homoscedastic residuals (Prob > χ^2 = 0,00), we used Huber-White adjusted errors to the estimation.

The estimated results of Model 5 are shown in the table in Appendix F, the LPM is in the first column and probit model is in the second one. Parameters of each variable are always in the first row and number of stars represents the level of significance (0,1%, 1% and 5%) for a parameter equalling zero. The t statistics are presented in parentheses for LPM and z statistics for probit model. Due to the characteristics of the models, we will focus on the effects rather than their magnitudes.

We tested a hypothesis that specific selection criteria lead to consequent public tendering or extraworks. We have identified contracts which were awarded as extraworks and used them as dependent variable. The independent variables than characterize public procurement in terms of estimated price, type of selection criteria, industry, presence of external administrator and EU founding. We have also included time trend to study the hypothesis of increasing phenomenon of extraworks over the last years.

The signs of coefficients and corresponding significance levels are quite consistent using both methods, LPM and probit model. Extraworks are usually awarded through negotiation without publication using rather lowest price criterion. The institution of extraworks is most common in industries such as construction works, transport and real estate services and services related to oil and gas industries. Effect of external administrators and EU founding are rather negative. It can be caused by the fact, that extraworks are just administrative procedure of extending the contract with already chosen supplier and in case of EU founding, the budget is already settled in the first contract awarding and it is very rarely increased.

We have further detected a significantly increasing trend over last years in extraworks which is presented in the following table. There have been more extraworks awarded in 2014 than in 2007 by around 1,6%. This trend can be

explained by an increasing trend of using lowest price criterion. Suppliers push the price as low as possible in order to win the contract and usually during the undertaking of the project, they find out that they run out of money and they need extended funding. Procurers then use the institution of extraworks.

Table 8: Time trend in extraworks

Year	Year dummy (LPM)
2007	0.013***
2008	0.010**
2009	0.016***
2010	0.019***
2011	0.025***
2012	0.023***
2013	- 0.002
2014	0.029***

Note: Year 2006 has been used as a base year.

Source: author's calculation

Analysing our hypothesis that an increasing trend of lowest price criterion leads to consequent public procurement tendering or extraworks is difficult to study due to incomplete data on public procurements. Procurers just fill the information that the contract is awarded as an extrawork but the actual information about the preceding procurement is missing. That is why we decided to focus on sector of construction works where this phenomenon is the most common. We counted, specifically for each procurer, all procurements awarded as extraworks and all procurements awarded in open and restricted procedures through lowest price criterion and MEAT selection controlling for number of contracts funded by EU. First we wanted to process an analysis of the effect of lowest price criterion on the extraworks. But after running a regression, the variable of lowest price criterion was not significant, thus we decided to focus on the MEAT selection process. We studied an effect between using MEAT criterion and extraworks among various procurers. The used model is as follows:

<u>Model:</u> $Extraworks/contracts\ in\ total = \alpha + \beta_1 MEAT/contracts\ in\ total + \beta_2\ P\_employees + \beta_3\ D\_EUfunds + \varepsilon$

Based on the results, presented in Appendix G, we can conclude that the more procurers apply MEAT selection process among all their undertaken procurements, the less extraworks they use by about 5%. The size of procurer in terms of number of employees does not affect the extraworks and the effect of funding from EU is just

slightly negative due to hardly extendable financial resources allocated through budget of undertaken project.

In conclusion, we can say that there has been an increasing trend of extraworks presented over the last years. It is generally believed that it steams from an increasing trend of lowest price criterion but this phenomenon could not be fully studied. But our hypothesis about the correlation between specific selection criteria and extraworks in the construction works cannot be rejected. We finally found out that procurers using higher rate of MEAT selection tend to use less extraworks.

6.4 Summary of econometric results

The advantage of economic approach to identify the effect of lowest price criterion in the selection process of public procurement is that it provides a proper explanation of the incentives that influence the selection criteria. And in the consequent step, it provides a proper explanation of effects of lowest price criterion. In conclusion our econometric results are following:

- Over the last years, there has been presented a significant increasing trend of using lowest price criterion and it is even stronger in case of contracts financed by EU funds. The result is in line with results of study of Janský, Křehlík and Skuhrovec (2015).

- Specific type of procurer affects the selected criterion of public procurement. Lowest price criterion is preferred by public institutions (such as municipalities, public administration, etc.) and larger contracting authorities in terms of number of employees. The effect can be explained by principal agent problem and the size of contracting authority even underlines this problem.

- Specific type of procurement in terms of procedure and subject of procurement affects the selected criterion of public procurement. When using less transparent types of procurements such as negotiation with publication, negotiation without publication, simplified below-threshold procedure, the probability of using lowest price criterion increases. Whereas others, such as restricted procedure and competitive dialogue prefer MEAT selection due to their two-round processes where the first one is a check for qualification. This result is in line with foundings of Palguta and Pertold (2015) which suggest that procurers are willing to manipulate anticipated price in order to award a

contract in simplified-below threshold procedure which is administratively easier and therefor apply also administratively easier selection criterion.

- Controlling for more specific sectoral specification, public procurement of more homogeneous subjects such as agriculture, natural sources and energy increase the probability of using lowest price criterion. Procuring subjects are better specified and therefore lowest price criterion is preferred as easier and more efficient selection criterion.

- Presence of external administrator is statistically significant in two cases, first, when contracts are financed by EU and second, in overlimit procurements. In case of sublimit procurement funded by EU, presence of external administrator leads to increased probability of using lowest price criterion. In overlimit procedures, the MEAT selection criterion is preferred when external administrator is presented. Presence of external administrator in the above mentioned cases can be explained by risk aversion of procurers who realize that EU funded procurements are highly exposed to controls of external auditors and overlimit procedures are administratively complicated.

- Number of bidders depends on the estimated price, type of procurement, selection procedure and varies across different procedures. Procurements with higher estimated price, awarded in open procedures are more interesting for bidders and therefore there is more bidders presented. Lowest price criterion leads to higher competition in terms of number of bidders as well. The effect might be explained by the study of Vyklicky (2013) which suggests that suppliers prefer less complicated and less costly demanding preparation of bids and they also consider procurements awarded based on the lowest price criterion to be more transparent and less administratively demanding.

- Different selection process leads to different ununiform market composition of suppliers. Specific companies win rather procurements awarded based on the lowest price criterion and other companies win mostly those awarded based on the MEAT selection. This result is connected with the fact that in various procurements in different industries, procurers prefer more lowest price criterion or MEAT selection due to the subject specification of a contract. Suppliers than rather operate in one industry in which they are winning the contracts.

- Specific type of procurement in terms of procedure and subject of procurement affects the type of supplier. More open and transparent

procedures lead to larger suppliers in terms of number of employees. Final winners of contracts for construction works, postal and telecommunication services, finance, insurance, research and development and related consulting services are rather larger companies which stems from the fact that rather big firms operate in these industries.

- Over the last years, there has been presented a significant increasing trend of OPC interventions. This phenomenon can be explained by increasing competitive struggle between firms operating in the same industry, tightening auditing measures and increasing pressure of controlling mechanisms over the last years.

- Public procurement awarded based on lowest price criterion are more stable in terms of OPC intervention than those awarded based on MEAT selection. This result steams from riskier process of setting specific criteria and selection in case of MEAT.

- Specific type of procurement in terms of procedure and subject of procurement affects the probability of intervention by OPC. Restricted procedure increases the probability of intervention by OPC comparing to open procedure whereas all other types of procurements decrease the probability. The most stable are procurements oriented on energy, financial and insurance services whereas purchasing equipment and providing transport, defence and educational services increase the probability of intervention by OPC.

- Procurements administrated by external administrator are more prone to OPC intervention. Procurers prefer to transfer responsibility and risk on external administrator even if they do not have to mean necessary more stable administrative process and lower probability of OPC intervention.

- Over the last years, there has been presented a significant increasing trend of extraworks. This phenomenon can be explained by increasing trend of lowest price criterion and suppliers' attempt to decrease the final price. Further estimation resulted in a conclusion that procurers using higher rate of MEAT selection tend to use less extraworks. Controlling for the quality of the proposed project in the first round of contract awarding might lead to potentional future cost savings in terms of overall price of the project and administration of procedure for extraworks.

7 Conclusion

Public procurement is an important institute to procure goods, services and construction works. It is a relatively new and publicly attractive topic. Procurements above certain threshold are regulated by Public Procurement Act whose aim is to provide more transparent, efficient and economically oriented framework for the whole process of procuring.

The first goal of this thesis was to present a detailed analysis of the current practice related to public procurement. We provided theoretical background through description of the process and defined different types of public procurement in terms of procurers, procedures and subject of procurements. Focus was further concentrated on the selection criteria and comprehensive analysis of their drivers and consequent effects.

Second part of the thesis was devoted to a proper analysis of the Czech public procurement practice. In order to assess the real impacts of different types of selection process, awarded contracts between 2006 and 2014 in the Czech Republic were analyzed. We worked with a unique representative sample of 130 490 awarded contracts. Thus, the sample offered an opportunity for studying the phenomenon of lowest price criterion which has a significantly increasing trend since 2006.

Procedural issues play a significant role in procurement process. A problem of principal agent and asymmetric information are well presented. Public officials as agents put the whole effort into an administration of public procurement but they do not receive full benefits. In private enterprises, agents are compensated by bonus or profit-sharing system in the case of principle agent problem, but in the Czech public sector, this compensation is not applicated. Therefore agents are not sufficiently motivated and they do not put the whole effort to maximize efficiency. This leads to the fact that public contracting authorities (such as municipalities, contributory organizations, public administration and public enterprises) more often prefer easier and administratively less complicated selection criterion, lowest price criterion. This is further accompanied with a significant effect of more frequent use of the lowest price criterion by procuring institutions with larger number of employees. Which just underlines the principle agent problem and inefficiency of large public institutions.

Further the results suggest that procurers set the selection criteria based on the specific sectors and the percentage of lowest price criterion thus differs among various categories of procurement contracts defined by CPV codes. For procurements with easily defined and more homogenous subject of procurement, such as agriculture, natural sources and energy, contracting authorities prefer lowest price criterion. In very specific categories, such as health, social and educational services and consulting services, contracting authorities prefer MEAT selection. This trend is given by the fact that once a subject of procurement is well defined and more homogenous across various suppliers, procurers can better anticipate and control the quality of goods or service they receive and therefore they tend to prefer using administratively easier selection criterion.

Our data also suggested an interesting trade off, in procurements awarded based on lowest price criterion, between higher competition in terms of number of bidders, higher stability in terms of less interventions of OPC but also higher probability of consequent extraworks. In line with previous studies, the results suggest that lowest price criterion leads to higher competition expressed in higher number of bidders. As it has already been suggested by Pavel (2008) and Vyklicky (2013), suppliers prefer well set selection criteria and they find lowest price criterion the most transparent.

We have also found out significant statistical evidence that specific type of selection criteria affects the probability of intervention by OPC. Due to riskier and more complex setting of MEAT selection criterion, procurements awarded based on this type of selection are more prone to interventions by OPC. But on the other hand, they lead to fewer extraworks awarded than procurements awarded based on lowest price criterion. So in the longer term, emphasizing the quality criteria in the selection process might lead to future cost savings in the overall price of the project.

There is still a need for further research of this topic in order to set appropriate rules for contract awarding process. Nevertheless, one big issue has been revealed and it is an incompleteness of the database of public procurements. Procurers are enforced to submit information about administrated public procurement but their completeness is not controlled. It leads to the problem of lacking information and presented misinformation in the database. For instance, contracts awarded as extraworks are just marked as extraworks but there is no linkage to the precedent procurement. That is why we would need to call for more open and transparent database with proper information provided allowing more precise evaluation. Especially, further studying of the effect of the lowest price criterion on extraworks awarded as this is a topic vastly discussed among all participants of procurement process.

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Appendix A: LPM and probit estimation of Model 1

Table 8: LPM and probit model for LP as dependent variable

	LPM b/p	Probit b/p
main		
logestimated	-0.024***	-0.093***
	(0.00)	(0.00)
DP_natural~n	-0.021	-0.066
	(0.35)	(0.39)
DP_municip~y	0.093***	0.287***
	(0.00)	(0.00)
DP_contrib~g	0.208***	0.690***
	(0.00)	(0.00)
DP_publica~n	0.135***	0.413***
	(0.00)	(0.00)
DP_publice~p	0.158***	0.493***
	(0.00)	(0.00)
DP_univers~y	0.108***	0.334***
	(0.00)	(0.00)
DP_inscomp	-0.090***	-0.210***
	(0.00)	(0.00)
P_empl	0.000***	0.000***
	(0.00)	(0.00)
D_restricted	-0.038***	-0.084***
	(0.00)	(0.00)
D_NwP	0.044***	0.129***
	(0.00)	(0.00)
D_NwithoutP	0.104***	0.331***
	(0.00)	(0.00)
D_dialogue	-0.355***	-1.545***
	(0.00)	(0.00)
D_simplified	0.049***	0.185***
	(0.00)	(0.00)
1.CPVs	0.000	0.000
	(.)	(.)
2.CPVs	0.918***	1.621**
	(0.00)	(0.01)
3.CPVs	0.625***	0.546***
	(0.00)	(0.00)
5.CPVs	0.650*	0.684
	(0.01)	(0.48)
9.CPVs	0.821***	1.358***
	(0.00)	(0.00)
10.CPVs	1.067***	0.000
	(0.00)	(.)
11.CPVs	0.672***	0.749**
	(0.00)	(0.01)
14.CPVs	0.664***	0.615***
	(0.00)	(0.00)
15.CPVs	0.522***	0.217*
	(0.00)	(0.04)

16.CPVs	0.580***	0.371***
	(0.00)	(0.00)
17.CPVs	0.721***	0.825***
	(0.00)	(0.00)
18.CPVs	0.265***	-0.520***
	(0.00)	(0.00)
19.CPVs	0.593***	0.459*
	(0.00)	(0.02)
20.CPVs	0.209***	0.000
	(0.00)	(.)
21.CPVs	0.679***	0.681**
	(0.00)	(0.01)
22.CPVs	0.519***	0.202*
	(0.00)	(0.02)
23.CPVs	0.832***	1.222***
	(0.00)	(0.00)
24.CPVs	0.841***	1.383***
	(0.00)	(0.00)
25.CPVs	0.353***	-0.170
	(0.00)	(0.34)
26.CPVs	0.454*	0.103
	(0.01)	(0.83)
27.CPVs	0.459***	0.147
	(0.00)	(0.59)
28.CPVs	0.604***	0.498***
	(0.00)	(0.00)
29.CPVs	0.426***	0.039
	(0.00)	(0.67)
30.CPVs	0.644***	0.656***
	(0.00)	(0.00)
31.CPVs	0.452***	0.029
	(0.00)	(0.72)
32.CPVs	0.553***	0.327***
	(0.00)	(0.00)
33.CPVs	0.471***	0.078
	(0.00)	(0.22)
34.CPVs	0.446***	0.011
	(0.00)	(0.86)
35.CPVs	0.593***	0.430***
	(0.00)	(0.00)
36.CPVs	0.481***	0.218
	(0.00)	(0.05)
37.CPVs	0.488***	0.128
	(0.00)	(0.22)
38.CPVs	0.464***	0.014
	(0.00)	(0.84)
39.CPVs	0.605***	0.488***
	(0.00)	(0.00)
40.CPVs	0.615***	0.592***
	(0.00)	(0.00)
41.CPVs	0.503**	0.133
	(0.00)	(0.75)
42.CPVs	0.469***	0.056
	(0.00)	(0.42)

43.CPVs	0.587***	0.416***
	(0.00)	(0.00)
44.CPVs	0.550***	0.285***
	(0.00)	(0.00)
45.CPVs	0.636***	0.614***
	(0.00)	(0.00)
48.CPVs	0.523***	0.223**
	(0.00)	(0.00)
50.CPVs	0.575***	0.403***
	(0.00)	(0.00)
51.CPVs	0.664***	0.707***
	(0.00)	(0.00)
55.CPVs	0.533***	0.315**
	(0.00)	(0.00)
60.CPVs	0.737***	0.919***
	(0.00)	(0.00)
62.CPVs	0.721***	0.943
	(0.00)	(0.06)
63.CPVs	0.568***	0.387**
	(0.00)	(0.00)
64.CPVs	0.479***	0.127
	(0.00)	(0.13)
65.CPVs	0.590***	0.498***
	(0.00)	(0.00)
66.CPVs	0.519***	0.287***
	(0.00)	(0.00)
67.CPVs	0.339*	-0.149
	(0.03)	(0.76)
70.CPVs	0.601***	0.526***
	(0.00)	(0.00)
71.CPVs	0.565***	0.358***
	(0.00)	(0.00)
72.CPVs	0.506***	0.184**
	(0.00)	(0.00)
73.CPVs	0.184***	-0.745***
	(0.00)	(0.00)
74.CPVs	0.611***	0.548***
	(0.00)	(0.00)
75.CPVs	0.583***	0.453***
	(0.00)	(0.00)
76.CPVs	0.473***	0.129
	(0.00)	(0.63)
77.CPVs	0.845***	1.731***
	(0.00)	(0.00)
78.CPVs	0.389***	-0.081
	(0.00)	(0.69)
79.CPVs	0.325***	-0.343***
	(0.00)	(0.00)
80.CPVs	0.275***	-0.491***
	(0.00)	(0.00)
83.CPVs	0.954***	0.000
	(0.00)	(.)
85.CPVs	0.641***	0.587***
	(0.00)	(0.00)
90.CPVs	0.685***	0.762***
	(0.00)	(0.00)
91.CPVs	0.605***	0.514
	(0.00)	(0.33)
92.CPVs	0.533***	0.249**
	(0.00)	(0.01)

92.CPVs	0.533***	0.249**
	(0.00)	(0.01)
93.CPVs	0.264***	-0.584**
	(0.00)	(0.00)
95.CPVs	0.021	0.000
	(0.25)	(.)
98.CPVs	0.443***	0.000
	(0.00)	(.)
D_2007	0.073***	0.152***
	(0.00)	(0.00)
D_2008	0.104***	0.271***
	(0.00)	(0.00)
D_2009	0.090***	0.249***
	(0.00)	(0.00)
D_2010	0.096***	0.263***
	(0.00)	(0.00)
D_2011	0.184***	0.540***
	(0.00)	(0.00)
D_2012	0.264***	0.774***
	(0.00)	(0.00)
D_2013	0.332***	0.986***
	(0.00)	(0.00)
D_2014	0.360***	1.119***
	(0.00)	(0.00)
D_EU2007	-0.185***	-0.457***
	(0.00)	(0.00)
D_EU2008	-0.153***	-0.397***
	(0.00)	(0.00)
D_EU2009	-0.055*	-0.127
	(0.02)	(0.05)
D_EU2010	0.014	0.055
	(0.54)	(0.40)
D_EU2011	-0.103***	-0.309***
	(0.00)	(0.00)
D_EU2012	-0.048*	-0.120
	(0.03)	(0.06)
D_EU2013	0.016	0.061
	(0.46)	(0.33)
D_EU2014	0.022	0.068
	(0.31)	(0.28)
D_administ~r	-0.126***	-0.373***
	(0.00)	(0.00)
D_EUfunds	0.075***	0.232***
	(0.00)	(0.00)
D_EUadmin	0.107***	0.343***
	(0.00)	(0.00)
D_overlima~n	-0.023**	-0.116***
	(0.00)	(0.00)
_cons	0.040*	0.227**
	(0.03)	(0.00)

LPM: Number of observations = 101 162, $R^2 = 0.2211$

Probit: Number of observations = 101 142, $Pseudo\,R^2 = 0.1974$

Appendix B: OLS assumptions of Model 2

In order to be sure that we can use ordinary least - squares regression with the best unbiased estimates in our econometric analysis, we have to check classical linear model asuumptions.

First assumption assumes the model to be **linear in parameters**. This is fulfilled by the composition of models described in the section 5.3 Hypotheses and specification of the models. All variables are in their base value, no squares or cubes have been included. The **randomness of data sample** is given the fact that they cover all public contracts awarded through public procurement since June 2006 to January 2015. As there was very insignificant amount of data which did not provide information on all characteristics of the procurement, we can say that the dataset covers a significant random sample of the entire procurement sample.

The next assumption of **homoscedasticity of residuals** (variance of error term is constant given any values of of the explanatory variables) have been first inpected visually on a graph of residuals plotted against their fitted values. The plot of residuals showed uneven unvelope of residuals, the width of the envelope was considerably larger for higher values of fitted values than for others. A formal Breusch-Pagan test was therefore conducted. The null hypothesis of homoscedasticity of residuals was rejected. The results of the test can be seen in the table. Fortunately, the heteroskedasticity of residuals does not cause biased estimators in the model. But the model has to be estimated in accordance with robust standard errors to be more trustworthy.

Next assumption of **normality of residuals** was tested by Shapiro – Wilk test. The null hypothesis of normally distributed residuals was also rejected as can be seen in the table. Nevertheless, the dataset is large enough to assume that the OLS estimators satisfy asymptotic normality which means that they are approximately normally distributed in large enough sample sizes. And therefore t and F statistics for testing the hypothesis are meaningful (Wooldridge, 2006).

Assumption of **absence of collinearity** was tested using variance inflation factor (VIF) as a red flag for a potential multicollinearity in a model. But according to the test, this kind of thread is not presented. In our case, the mean VIF is 1,65 and the high multicollinearity is presented when this mean equals to ten or higher.

Table 9: Results of tests for OLS assumptions

Test	Statistics	Probability
Breusch – Pagan (H0: constant variance of residuals)	χ^2 = 80 143,67	Prob > χ^2 = 0
Sharpiro – Wilk (H0: normal distribution of residuals)	z = 26,625	Prob > z = 0
Variance inflation factor	Mean VIF = 1,65	

One of the least tests is a **correct model specification**. For this purpose, Ramsey RESET test using owers of the fitted values of dependent variable was used and the hypothesis that the model has no omitted variables was rejected (Prob > F = 0) and therefore the test expects some corrections of the model. But due to the characteristics of the independent variables (most of them are binary variables), it would not make any sense to add squared explanatory variables. And it was already proved that RESET has no power for detecting omitted variables whenever they have expectations that are linear in the included independent variables n the model and therefore RESET is just considered as functional form test, nothing more (Wooldridge, 2006).

As a conclusion, we can say that the linear model assumptions were tested and the potential drawbacks were either resolved or discussed so the classical OLS estimation can be applied on the empirical study.

Appendix C: OLS estimation of Model 2

Table 10: OLS models for number of bidders as dependent variable with robust standard errors and adjusting for clusters in contracting authorities

	serobust b/p	clusters b/p
logestimated	0.226***	0.225***
	(0.00)	(0.00)
D_LP	0.488***	0.488**
	(0.00)	(0.01)
D_restricted	-1.561***	-1.564***
	(0.00)	(0.00)
D_NwP	-1.254***	-1.254***
	(0.00)	(0.00)
D_NwithoutP	-4.264***	-4.265***
	(0.00)	(0.00)
D_dialogue	-1.840***	-1.836***
	(0.00)	(0.00)
D_simplified	-0.359***	-0.364
	(0.00)	(0.60)
1.CPVs	0.000	0.000
	(.)	(.)
2.CPVs	-1.124	-1.124
	(0.53)	(0.57)
3.CPVs	3.206***	3.251
	(0.00)	(0.17)
5.CPVs	-3.196***	-3.197***
	(0.00)	(0.00)
9.CPVs	-2.321***	-2.316***
	(0.00)	(0.00)
10.CPVs	-2.576***	-2.457***
	(0.00)	(0.00)
11.CPVs	-5.034***	-5.251***
	(0.00)	(0.00)
14.CPVs	-2.465***	-2.465***
	(0.00)	(0.00)
15.CPVs	-3.143***	-3.144***
	(0.00)	(0.00)
16.CPVs	-2.746***	-2.735***
	(0.00)	(0.00)
17.CPVs	-2.297***	-2.297***
	(0.00)	(0.00)
18.CPVs	-2.361***	-2.361***
	(0.00)	(0.00)
19.CPVs	-2.291***	-2.291***
	(0.00)	(0.00)
20.CPVs	-1.502	-1.499
	(0.06)	(0.10)
21.CPVs	-1.034*	-1.035
	(0.05)	(0.19)
22.CPVs	-1.926***	-1.979***
	(0.00)	(0.00)
23.CPVs	-4.467***	-4.466***
	(0.00)	(0.00)

24.CPVs	-3.495***	-3.494***
	(0.00)	(0.00)
25.CPVs	-1.891***	-1.891***
	(0.00)	(0.00)
26.CPVs	-2.607***	-2.606***
	(0.00)	(0.00)
27.CPVs	-3.292***	-3.292***
	(0.00)	(0.00)
28.CPVs	-1.586***	-1.586***
	(0.00)	(0.00)
29.CPVs	-2.716***	-2.716***
	(0.00)	(0.00)
30.CPVs	-2.250***	-2.237***
	(0.00)	(0.00)
31.CPVs	-2.838***	-2.833***
	(0.00)	(0.00)
32.CPVs	-2.831***	-2.828***
	(0.00)	(0.00)
33.CPVs	-3.063***	-3.063***
	(0.00)	(0.00)
34.CPVs	-3.265***	-3.265***
	(0.00)	(0.00)
35.CPVs	-3.154***	-3.154***
	(0.00)	(0.00)
36.CPVs	0.293	0.293
	(0.59)	(0.85)
37.CPVs	-2.294***	-2.270***
	(0.00)	(0.00)
38.CPVs	-3.621***	-3.624***
	(0.00)	(0.00)
39.CPVs	-1.387***	-1.361***
	(0.00)	(0.00)
40.CPVs	-2.900***	-2.899***
	(0.00)	(0.00)
41.CPVs	-2.273***	-2.272**
	(0.00)	(0.01)
42.CPVs	-2.997***	-2.997***
	(0.00)	(0.00)
43.CPVs	-3.169***	-3.183***
	(0.00)	(0.00)
44.CPVs	-1.618***	-1.606***
	(0.00)	(0.00)
45.CPVs	0.263***	0.271
	(0.00)	(0.16)
48.CPVs	-3.074***	-3.081***
	(0.00)	(0.00)
50.CPVs	-2.502***	-2.503***
	(0.00)	(0.00)
51.CPVs	-2.638***	-2.637***
	(0.00)	(0.00)
55.CPVs	-2.903***	-2.943***
	(0.00)	(0.00)
60.CPVs	-2.245***	-2.214***
	(0.00)	(0.00)
62.CPVs	-2.243	-2.242
	(0.07)	(0.22)
63.CPVs	-3.041***	-3.047***
	(0.00)	(0.00)

64.CPVs	-3.212***	-3.212***
	(0.00)	(0.00)
65.CPVs	2.319**	2.320
	(0.01)	(0.33)
66.CPVs	-3.402***	-3.404***
	(0.00)	(0.00)
67.CPVs	-2.908***	-2.908***
	(0.00)	(0.00)
70.CPVs	-2.099***	-2.099***
	(0.00)	(0.00)
71.CPVs	0.630***	0.637
	(0.00)	(0.07)
72.CPVs	-2.144***	-2.144***
	(0.00)	(0.00)
73.CPVs	-3.435***	-3.434***
	(0.00)	(0.00)
74.CPVs	-1.590***	-1.639***
	(0.00)	(0.00)
75.CPVs	-2.747***	-2.747***
	(0.00)	(0.00)
76.CPVs	-2.397***	-2.395***
	(0.00)	(0.00)
77.CPVs	3.524***	3.530*
	(0.00)	(0.01)
78.CPVs	-0.655	-0.655
	(0.30)	(0.62)
79.CPVs	-0.946***	-0.939**
	(0.00)	(0.00)
80.CPVs	-2.852***	-2.874***
	(0.00)	(0.00)
83.CPVs	-3.942***	-3.942***
	(0.00)	(0.00)
85.CPVs	-4.120***	-4.120***
	(0.00)	(0.00)
90.CPVs	-0.523***	-0.510
	(0.00)	(0.25)
91.CPVs	-3.712***	-3.711***
	(0.00)	(0.00)
92.CPVs	-1.722***	-1.722
	(0.00)	(0.10)
93.CPVs	-1.094*	-1.093
	(0.03)	(0.28)
95.CPVs	-2.255*	-2.256***
	(0.04)	(0.00)
98.CPVs	-2.613***	-2.610***
	(0.00)	(0.00)
_cons	2.825***	2.837**
	(0.00)	(0.00)

SErobust: Number of observations = 102 746, $R^2 = 0.1957$

Clusters: Number of observations = 102 021, $Pseudo\ R^2 = 0.1953$

Appendix D: OLS estimation of Model 3

Table 11: OLS models for market differentiation of suppliers in terms of number of employees as dependent variables with robust standard errors and adjusted for clusters of contracting authorities

	serobust b/p	clusters b/p
logestimated	37.936***	37.790***
	(0.00)	(0.00)
D_LP	24.421***	24.205
	(0.00)	(0.18)
D_restricted	-15.412	-15.070
	(0.24)	(0.51)
D_NwP	-34.915***	-35.007**
	(0.00)	(0.01)
D_NwithoutP	114.558***	116.079***
	(0.00)	(0.00)
D_dialogue	-98.641	-98.411
	(0.33)	(0.35)
D_simplified	-41.196***	-41.489***
	(0.00)	(0.00)
bidders_co~t	-2.718***	-2.738**
	(0.00)	(0.00)
D_EUfunds	-13.533**	-13.062
	(0.00)	(0.41)
1.CPVs	0.000	0.000
	(.)	(.)
2.CPVs	-55.346*	-55.484
	(0.05)	(0.17)
3.CPVs	25.344	25.735
	(0.37)	(0.58)
5.CPVs	230.625	230.642
	(0.19)	(0.20)
9.CPVs	37.713***	37.923
	(0.00)	(0.22)
10.CPVs	-37.312**	-33.132
	(0.00)	(0.07)
11.CPVs	-5.508	-46.569
	(0.83)	(0.11)
14.CPVs	229.466***	229.401***
	(0.00)	(0.00)
15.CPVs	213.505***	213.300**
	(0.00)	(0.00)
16.CPVs	31.420***	30.937*
	(0.00)	(0.04)
17.CPVs	-20.093	-20.313
	(0.27)	(0.35)
18.CPVs	77.674***	77.431**
	(0.00)	(0.01)
19.CPVs	113.890**	113.682
	(0.01)	(0.12)
20.CPVs	-59.457	-59.746
	(0.20)	(0.14)

21.CPVs	149.148	149.175
	(0.07)	(0.33)
22.CPVs	122.789***	124.037**
	(0.00)	(0.00)
23.CPVs	104.453**	104.640
	(0.00)	(0.13)
24.CPVs	151.992***	152.620***
	(0.00)	(0.00)
25.CPVs	81.428	81.313
	(0.18)	(0.17)
26.CPVs	-106.071***	-106.434**
	(0.00)	(0.00)
27.CPVs	190.698**	190.507
	(0.01)	(0.07)
28.CPVs	409.529***	409.443*
	(0.00)	(0.04)
29.CPVs	23.166	22.830
	(0.15)	(0.38)
30.CPVs	88.020***	87.621***
	(0.00)	(0.00)
31.CPVs	234.533***	235.231**
	(0.00)	(0.00)
32.CPVs	173.722***	169.627**
	(0.00)	(0.01)
33.CPVs	156.679***	156.636***
	(0.00)	(0.00)
34.CPVs	65.945***	65.837***
	(0.00)	(0.00)
35.CPVs	16.149	15.925
	(0.15)	(0.52)
36.CPVs	21.353	21.224
	(0.15)	(0.57)
37.CPVs	27.416*	26.385
	(0.02)	(0.22)
38.CPVs	26.900***	25.601
	(0.00)	(0.24)
39.CPVs	33.551***	32.865*
	(0.00)	(0.04)
40.CPVs	104.247***	104.180**
	(0.00)	(0.00)
41.CPVs	454.780*	453.609*
	(0.01)	(0.03)
42.CPVs	37.118***	36.794*
	(0.00)	(0.04)
43.CPVs	25.048	24.504
	(0.19)	(0.40)
44.CPVs	114.308***	113.423***
	(0.00)	(0.00)
45.CPVs	301.576***	302.605***
	(0.00)	(0.00)
48.CPVs	103.015***	102.676***
	(0.00)	(0.00)
50.CPVs	181.551***	190.213***
	(0.00)	(0.00)
51.CPVs	131.718*	131.373
	(0.05)	(0.05)
55.CPVs	330.831***	328.559***
	(0.00)	(0.00)
60.CPVs	62.596***	64.500
	(0.00)	(0.09)

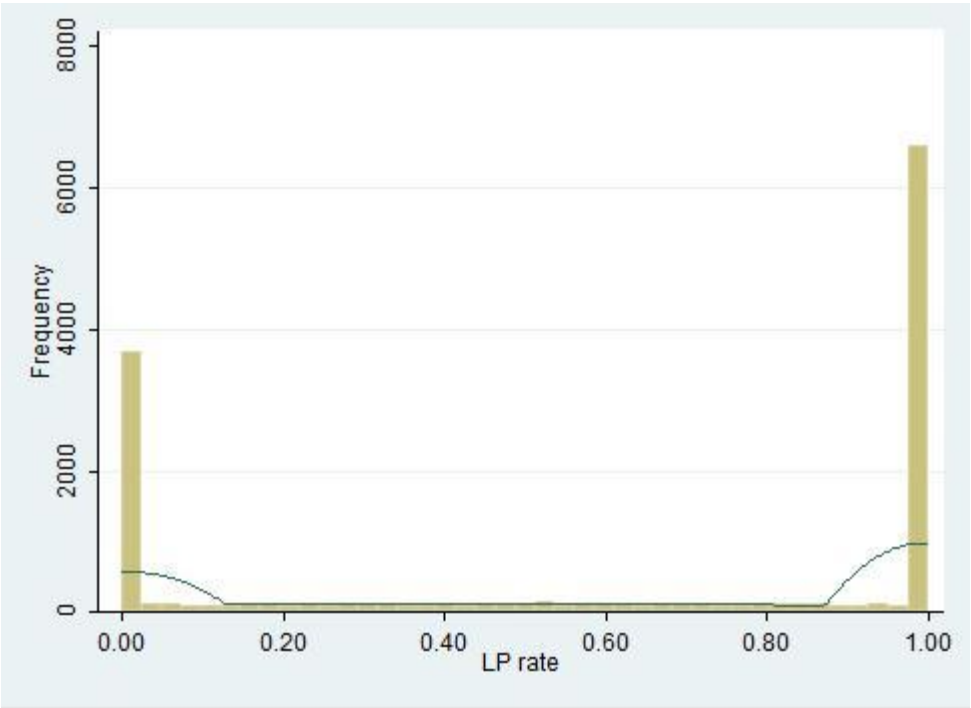
62.CPVs	-109.107***	-108.873***
	(0.00)	(0.00)
63.CPVs	-20.882	-19.612
	(0.53)	(0.67)
64.CPVs	2083.730***	2083.382***
	(0.00)	(0.00)
65.CPVs	197.172***	196.916
	(0.00)	(0.20)
66.CPVs	2873.591***	2874.011***
	(0.00)	(0.00)
67.CPVs	-3.559	-3.505
	(0.85)	(0.87)
70.CPVs	-0.746	-0.986
	(0.96)	(0.96)
71.CPVs	46.993***	47.358**
	(0.00)	(0.00)
72.CPVs	177.763***	177.078**
	(0.00)	(0.00)
73.CPVs	445.474***	445.141***
	(0.00)	(0.00)
74.CPVs	75.066***	75.856**
	(0.00)	(0.00)
75.CPVs	87.165	86.908
	(0.05)	(0.17)
76.CPVs	66.953	67.037
	(0.44)	(0.47)
77.CPVs	79.548***	79.455***
	(0.00)	(0.00)
78.CPVs	61.107*	60.976
	(0.04)	(0.14)
79.CPVs	69.089***	68.460***
	(0.00)	(0.00)
80.CPVs	102.382***	101.817**
	(0.00)	(0.00)
83.CPVs	-93.921***	-94.179***
	(0.00)	(0.00)
85.CPVs	65.981***	65.282
	(0.00)	(0.12)
90.CPVs	212.467***	213.557***
	(0.00)	(0.00)
91.CPVs	138.803	138.635
	(0.16)	(0.19)
92.CPVs	-16.729*	-17.420
	(0.04)	(0.36)
93.CPVs	110.948**	110.900
	(0.01)	(0.12)
95.CPVs	88.479**	87.798***
	(0.00)	(0.00)
98.CPVs	62.354***	62.014**
	(0.00)	(0.00)
_cons	-518.198***	-515.783***
	(0.00)	(0.00)

.

SErobust: Number of observations = 102 407, $R^2 = 0.2334$

Clusters: Number of observations = 101 682, $Pseudo\ R^2 = 0.2333$

Figure 17: Distribution of procurements awarded based on lowest price criterion



Appendix E: LPM and probit estimation of Model 4

Table 12: LPM and probit model for OPC interventions as dependent variable

	LPM b/p	Probit b/p
main		
logestimated	0.009***	0.205***
	(0.00)	(0.00)
D_restricted	0.027***	0.177***
	(0.00)	(0.00)
D_NwP	-0.008***	-0.473***
	(0.00)	(0.00)
D_NwithoutP	-0.005***	-0.642***
	(0.00)	(0.00)
D_dialogue	-0.056***	0.000
	(0.00)	(.)
D_simplified	-0.012***	-0.862***
	(0.00)	(0.00)
1.CPVs	0.000	0.000
	(.)	(.)
2.CPVs	-0.008	0.000
	(0.12)	(.)
3.CPVs	-0.019***	0.000
	(0.00)	(.)
5.CPVs	0.007	0.000
	(0.34)	(.)
9.CPVs	-0.021***	-0.969***
	(0.00)	(0.00)
10.CPVs	0.004	0.000
	(0.36)	(.)
11.CPVs	-0.014***	0.000
	(0.00)	(.)
14.CPVs	0.002	-0.102
	(0.59)	(0.68)
15.CPVs	-0.004	0.000
	(0.19)	(.)
16.CPVs	-0.010***	0.000
	(0.00)	(.)
17.CPVs	0.013	0.470
	(0.57)	(0.34)
18.CPVs	0.016*	0.471*
	(0.02)	(0.05)
19.CPVs	-0.000	0.000
	(0.92)	(.)
20.CPVs	-0.031**	0.000
	(0.00)	(.)

21.CPVs	-0.004	0.000
	(0.35)	(.)
22.CPVs	0.020***	-0.088
	(0.00)	(0.80)
23.CPVs	-0.014***	0.000
	(0.00)	(.)
24.CPVs	-0.007*	0.000
	(0.01)	(.)
25.CPVs	-0.003	0.000
	(0.32)	(.)
26.CPVs	-0.009	0.000
	(0.14)	(.)
27.CPVs	-0.004	0.000
	(0.10)	(.)
28.CPVs	-0.001	0.007
	(0.89)	(0.98)
29.CPVs	-0.005	-0.054
	(0.23)	(0.85)
30.CPVs	0.006*	0.206
	(0.04)	(0.30)
31.CPVs	-0.011*	-0.155
	(0.01)	(0.54)
32.CPVs	0.004	0.298
	(0.38)	(0.15)
33.CPVs	0.015***	0.525**
	(0.00)	(0.00)
34.CPVs	-0.001	0.152
	(0.64)	(0.42)
35.CPVs	0.021*	0.672**
	(0.02)	(0.00)
36.CPVs	0.008	0.340
	(0.40)	(0.25)
37.CPVs	0.033**	0.788**
	(0.01)	(0.00)
38.CPVs	-0.009**	-0.267
	(0.00)	(0.19)
39.CPVs	0.002	0.224
	(0.66)	(0.27)
40.CPVs	-0.016***	0.000
	(0.00)	(.)
41.CPVs	-0.014**	0.000
	(0.01)	(.)
42.CPVs	-0.010**	-0.147
	(0.00)	(0.49)
43.CPVs	-0.002	0.247
	(0.85)	(0.42)
44.CPVs	-0.008*	-0.095
	(0.04)	(0.68)
45.CPVs	-0.008**	-0.098
	(0.00)	(0.60)
48.CPVs	0.007	0.382
	(0.12)	(0.06)
50.CPVs	0.012*	0.409*
	(0.01)	(0.04)
51.CPVs	-0.021***	0.000
	(0.00)	(.)
55.CPVs	0.003	0.258
	(0.76)	(0.31)
60.CPVs	0.132***	1.140***
	(0.00)	(0.00)

55.CPVs	0.003	0.258
	(0.76)	(0.31)
60.CPVs	0.132***	1.140***
	(0.00)	(0.00)
62.CPVs	0.247	1.493**
	(0.16)	(0.01)
63.CPVs	-0.013	-0.096
	(0.27)	(0.78)
64.CPVs	0.021*	0.453*
	(0.01)	(0.03)
65.CPVs	-0.004	0.369
	(0.84)	(0.21)
66.CPVs	-0.022***	-0.723**
	(0.00)	(0.01)
67.CPVs	0.001	0.000
	(0.62)	(.)
70.CPVs	0.042*	0.694**
	(0.01)	(0.00)
71.CPVs	0.005	0.186
	(0.13)	(0.33)
72.CPVs	-0.002	0.162
	(0.61)	(0.41)
73.CPVs	0.019	0.583*
	(0.11)	(0.01)
74.CPVs	0.012**	0.437*
	(0.00)	(0.03)
75.CPVs	0.088***	1.248***
	(0.00)	(0.00)
76.CPVs	-0.026***	0.000
	(0.00)	(.)
77.CPVs	0.033***	0.775***
	(0.00)	(0.00)
78.CPVs	-0.020***	0.000
	(0.00)	(.)
79.CPVs	0.009*	0.375
	(0.02)	(0.05)
80.CPVs	0.038***	0.919***
	(0.00)	(0.00)
83.CPVs	-0.034***	0.000
	(0.00)	(.)
85.CPVs	-0.020***	-0.254
	(0.00)	(0.24)
90.CPVs	0.029***	0.626***
	(0.00)	(0.00)
91.CPVs	-0.009*	0.000
	(0.04)	(.)
92.CPVs	0.004	0.321
	(0.57)	(0.22)
93.CPVs	-0.005	0.141
	(0.76)	(0.71)
95.CPVs	0.000	0.000
	(0.83)	(.)
98.CPVs	-0.004	0.000
	(0.46)	(.)

D_2007	-0.005	-0.132
	(0.10)	(0.10)
D_2008	-0.001	0.029
	(0.87)	(0.69)
D_2009	0.002	0.053
	(0.57)	(0.42)
D_2010	-0.002	-0.005
	(0.59)	(0.94)
D_2011	0.007*	0.100
	(0.03)	(0.15)
D_2012	0.016***	0.284***
	(0.00)	(0.00)
D_2013	0.015***	0.253***
	(0.00)	(0.00)
D_2014	0.019***	0.273***
	(0.00)	(0.00)
D_LP2007	-0.006*	-0.092
	(0.04)	(0.31)
D_LP2008	0.005	-0.048
	(0.15)	(0.51)
D_LP2009	-0.005	-0.170*
	(0.05)	(0.01)
D_LP2010	0.002	-0.077
	(0.48)	(0.24)
D_LP2011	0.005	0.082
	(0.11)	(0.16)
D_LP2012	-0.008*	-0.193***
	(0.02)	(0.00)
D_LP2013	-0.019***	-0.455***
	(0.00)	(0.00)
D_LP2014	-0.017***	-0.301***
	(0.00)	(0.00)
D_administ~r	0.062***	0.521***
	(0.00)	(0.00)
D_EUfunds	0.009***	0.198***
	(0.00)	(0.00)
D_EUadmin	-0.025***	-0.256***
	(0.00)	(0.00)
D_sublimad~n	-0.034***	-0.111**
	(0.00)	(0.01)
_cons	-0.122***	-5.640***
	(0.00)	(0.00)

LPM: Number of observations = 104 926, $R^2 = 0.0536$

Probit: Number of observations = 102 204, $Pseudo\,R^2 = 0.2196$

Appendix F: LPM and probit estimation of Model 5

Table 13: LPM and probit model for extraworks as dependent variable

	LPM b/p	Probit b/p
main		
logestimated	-0.019***	-0.242***
	(0.00)	(0.00)
D_LP	0.012***	0.168***
	(0.00)	(0.00)
1.CPVs	0.000	0.000
	(.)	(.)
2.CPVs	-0.007	0.000
	(0.52)	(.)
3.CPVs	0.000	0.000
	(1.00)	(.)
5.CPVs	-0.006	0.000
	(0.67)	(.)
9.CPVs	0.000	-1.209***
	(0.94)	(0.00)
10.CPVs	-0.023***	0.000
	(0.00)	(.)
11.CPVs	0.006	0.000
	(0.40)	(.)
14.CPVs	-0.028***	-1.440***
	(0.00)	(0.00)
15.CPVs	-0.027***	0.000
	(0.00)	(.)
16.CPVs	-0.009**	-0.794*
	(0.01)	(0.02)
17.CPVs	0.002	0.000
	(0.67)	(.)
18.CPVs	-0.030***	-1.559***
	(0.00)	(0.00)
19.CPVs	-0.008	-0.331
	(0.57)	(0.40)
20.CPVs	0.045***	0.000
	(0.00)	(.)
21.CPVs	-0.008	0.000
	(0.16)	(.)
22.CPVs	-0.064***	0.000
	(0.00)	(.)
23.CPVs	0.013**	0.000
	(0.01)	(.)
24.CPVs	-0.014***	-1.416***
	(0.00)	(0.00)
25.CPVs	-0.001	0.000
	(0.66)	(.)

26.CPVs	0.152	1.217
	(0.24)	(0.05)
27.CPVs	-0.000	0.000
	(0.95)	(.)
28.CPVs	0.013	-0.144
	(0.07)	(0.55)
29.CPVs	0.028***	0.140
	(0.00)	(0.48)
30.CPVs	-0.018***	-0.837***
	(0.00)	(0.00)
31.CPVs	0.024***	0.152
	(0.00)	(0.36)
32.CPVs	0.016***	0.025
	(0.00)	(0.87)
33.CPVs	-0.013***	-0.835***
	(0.00)	(0.00)
34.CPVs	0.005*	-0.363**
	(0.03)	(0.01)
35.CPVs	-0.010	-0.679**
	(0.06)	(0.00)
36.CPVs	0.044**	0.406
	(0.00)	(0.05)
37.CPVs	-0.010	-0.359
	(0.21)	(0.14)
38.CPVs	-0.020***	-0.972***
	(0.00)	(0.00)
39.CPVs	-0.001	-0.293*
	(0.77)	(0.05)
40.CPVs	0.010**	0.000
	(0.00)	(.)
41.CPVs	0.001	0.000
	(0.92)	(.)
42.CPVs	0.012**	-0.126
	(0.00)	(0.40)
43.CPVs	0.007	-0.194
	(0.43)	(0.48)
44.CPVs	0.035***	0.343*
	(0.00)	(0.02)
45.CPVs	0.107***	0.969***
	(0.00)	(0.00)
48.CPVs	0.003	-0.261
	(0.50)	(0.09)
50.CPVs	0.018***	-0.076
	(0.00)	(0.61)
51.CPVs	0.024	0.179
	(0.12)	(0.58)
55.CPVs	-0.003	-0.947*
	(0.51)	(0.03)
60.CPVs	0.007	-0.320
	(0.25)	(0.11)
62.CPVs	0.037***	0.000
	(0.00)	(.)
63.CPVs	0.077***	0.757**
	(0.00)	(0.00)
64.CPVs	0.015**	-0.484*
	(0.01)	(0.02)
65.CPVs	0.020*	0.060
	(0.01)	(0.89)
66.CPVs	0.017***	-0.144
	(0.00)	(0.39)
67.CPVs	-0.004	0.000
	(0.33)	(.)
70.CPVs	0.054***	0.484*
	(0.00)	(0.02)

66.CPVs	0.017***	-0.144
	(0.00)	(0.39)
67.CPVs	-0.004	0.000
	(0.33)	(.)
70.CPVs	0.054***	0.484*
	(0.00)	(0.02)
71.CPVs	0.035***	0.164
	(0.00)	(0.20)
72.CPVs	0.009**	-0.093
	(0.00)	(0.49)
73.CPVs	0.001	0.000
	(0.57)	(.)
74.CPVs	0.020***	0.051
	(0.00)	(0.72)
75.CPVs	0.019	-0.070
	(0.12)	(0.80)
76.CPVs	0.118**	0.975**
	(0.00)	(0.00)
77.CPVs	-0.037***	-1.212***
	(0.00)	(0.00)
78.CPVs	0.025	0.081
	(0.20)	(0.87)
79.CPVs	-0.002	-0.549***
	(0.55)	(0.00)
80.CPVs	-0.034***	-2.090***
	(0.00)	(0.00)
83.CPVs	0.009*	0.000
	(0.01)	(.)
85.CPVs	0.009**	-0.251
	(0.01)	(0.13)
90.CPVs	0.010**	-0.133
	(0.01)	(0.35)
91.CPVs	0.105	1.170*
	(0.25)	(0.02)
92.CPVs	0.062***	0.443**
	(0.00)	(0.01)
93.CPVs	0.017***	0.000
	(0.00)	(.)
95.CPVs	-0.003	0.000
	(0.21)	(.)
98.CPVs	0.011	0.000
	(0.14)	(.)
D_2007	0.013***	0.156**
	(0.00)	(0.00)
D_2008	0.010**	0.147**
	(0.00)	(0.00)
D_2009	0.016***	0.257***
	(0.00)	(0.00)
D_2010	0.019***	0.280***
	(0.00)	(0.00)
D_2011	0.025***	0.303***
	(0.00)	(0.00)
D_2012	0.023***	0.238***
	(0.00)	(0.00)
D_2013	-0.002	-0.116*
	(0.50)	(0.01)
D_2014	0.029***	0.302***
	(0.00)	(0.00)
D_administ~r	-0.018***	-1.000***
	(0.00)	(0.00)
D_EUfunds	-0.018***	-0.175***

D_2014	0.029***	0.302***
	(0.00)	(0.00)
D_administ~r	-0.018***	-1.000***
	(0.00)	(0.00)
D_EUfunds	-0.018***	-0.175***
	(0.00)	(0.00)
_cons	0.272***	1.298***
	(0.00)	(0.00)

LPM: Number of observations = 104 926, $R^2 = 0.0850$

Probit: Number of observations = 103 050, $Pseudo\,R^2 = 0.2648$

Table 14: OLS model with robust standard errors for extraworks/total contracts as dependent variable

	extraworks
	b/p
multirate	-0.052*
	(0.02)
P_empl	0.000
	(0.88)
SumofD_EUf~s	-0.000*
	(0.01)
_cons	0.100***
	(0.00)

OLS: Number of observations = 5 599, $R^2 = 0.0182$

Appendix G: List of CPV codes

CPV number	Category	CPV number	Category
3	Agricultural, farming, fishing, forestry and related products	48	Software package and information systems
9	Petroleum products, fuel, electricity and other sources of energy	50	Repair and maintenance services
14	Mining, basic metals and related products	51	Installation services
15	Food, beverages, tobacco and related products	55	Hotel, restaurant and retail trade services
16	Agricultural machinery	60	Transport services
18	Clothing, footwear, luggage articles and accessories	63	Supporting and auxiliary transport services; travel agencies services
19	Leather and textile fabrics, plastic and rubber materials	64	Postal and telecommunications services
22	Printed matter and related products	65	Public utilities
24	Chemical products	66	Financial and insurance services
30	Office and computing machinery, equipment and supplies except furniture and software packages	70	Real estate services
31	Electrical machinery, apparatus, equipment and consumables; Lighting	71	Architectural, construction, engineering and inspection services
32	Radio, television, communication, telecommunication and related equipment	72	IT services
33	Medical equipments, pharmaceuticals and personal care products	73	Research and development services and related consultancy services
34	Transport equipment and	75	Administration, defence and

	auxiliary products to transportation		social security services
35	Security, fire-fighting, police and defence equipment	76	Services related to the oil and gas industry
37	Musical instruments, sport goods, games, toys, handicraft, art materials and accessories	77	Agricultural, forestry, horticultural, aquacultural and apicultural services
38	Laboratory, optical and precision equipments (excl. glasses)	79	Business services
39	Furniture (incl. office furniture), furnishings, domestic appliances (excl. lighting) and cleaning products	80	Education and training services
41	Collected and purified water	85	Health and social work services
42	Industrial machinery	90	Sewage-, refuse-, cleaning-, and environmental services
43	Machinery for mining, quarrying, construction equipment	92	Recreational, cultural and sporting services
44	Construction structures and materials; auxiliary products to construction	98	Other community, social and personal services
45	Construction work		